Department Energy and Environment
Natural Resources Administration
Water Quality Division

WATER POLLUTION CONTROL PROGRAM

Fiscal Year 2018 Clean Water Act § 106 Grant
SEMI-ANNUAL STATUS REPORT

Reporting Period
October 2017 - March 2018

WATER QUALITY DIVISON
STANDARDS AND TMDL BRANCH

A. Implementation

(1) Water Quality Standards (WQS)

Review of the US Environmental Protection Agency (EPA) Guidance

The Water Quality Division (WQD) reviewed the:

- EPA recommended final water quality criteria guidance on recreation *for E. coli*, human health for 94 organics, and aquatic life criteria for ammonia, cadmium, and selenium;
- Draft Human Health Recreational Ambient Water Quality Criteria and/or Swimming Advisories for Microcystins and Cylindrospermopsin, and aluminum;
- Methodologies and the basis for updates to the national criteria; and
- EPA guidance on the Final Rulemaking to Update the National Water Quality Standards Regulation.

WQS Triennial Review

DOEE proposed changes to the District's WQS in September 2017. Comments were submitted before the end of the –extended public comment period, December 2017. Since that time, DOEE has reviewed all public comments and is making changes to address those comments. In addition, DOEE and EPA discussed paths forward and agreed upon a strategy for progress. EPA proposed and DOEE agreed that DOEE would not enact the proposed changes to the *E. coli* criteria at this time. The rationale for not incorporating the *E. coli* criteria, which were based on the 2012 EPA recommendation for recreational waters is:

- Prior to 2012, both DOEE and EPA approved DC Water's Long-Term Control Plan (LTCP). This plan was based, in part, on compliance with the *E. coli* criteria in the current WQS. Implementation of the LTCP is still underway. The first phase of the Anacostia River Tunnel System, which is part of the LTCP, was put into operation in March 2018. According to DC Water models, it is anticipated that the tunnel will reduce combined sewer overflows to the river by 81 percent, with the ultimate LTCP goal of reducing combined sewer overflows into the Anacostia River by 98 percent. To adequately and completely determine the ability of the LTCP to reduce *E. coli* concentrations in the District's water, DOEE needs additional time to gather data and verify that the performance is consistent with the DC Water modeling as the LTCP is implemented. Implementation of the LTCP is still underway. Therefore, DOEE believes it is inadvisable to adopt updated *E. coli* criteria. EPA agreed to this strategy.

DOEE is moving forward with the other EPA recommended changes to ammonia, cadmium, and human health criteria for 94 organics in a second proposed rulemaking. This second proposed rulemaking for DC's WQS will be sent out for public comment in the near future.

For the 2016 Triennial Review, WQD proposed to:

- Adopt EPA recommended WQS for human health criteria for 94 organics based on updated exposure input values, best available science, extensive scientific literature review, and established procedures for risk assessment;
- Revise ammonia aquatic life criteria calculations which include tables and formulas; and
- Revise calculations for cadmium aquatic life criteria which include hardness based formulas for the acute and chronic durations.

WQD notified major permit holders in the District about EPA's proposed water quality criteria on recreation, human health and aquatic life. WQD also conducted comparison research on other state's WQS, in EPA Region 3, for information and consistency.

WQD continues to participate in regular EPA Region 3 water quality standards coordinator meetings, EPA webinars, conference calls, and trainings (e.g., programmatic staff attending the WQS Academy) to discuss WQS issues and new developments.

(2) TMDL Related Activities

Chesapeake Bay TMDL

Pursuant to § 303(d) of the Clean Water Act (CWA), EPA established the Chesapeake Bay-wide total maximum daily load (TMDL) for nutrients and sediment for all impaired segments in the tidal portion of the Chesapeake Bay watershed, on December 29, 2010. As a signatory to the EPA Chesapeake Bay Agreement, the District has been actively working with EPA and the other partner jurisdictions (Maryland, Virginia, Pennsylvania, West Virginia, New York, and Delaware) to develop and implement the Chesapeake Bay TMDL.

WQD regularly participated in the Bay Water Quality Goal Implementation Team (WQGIT) conference calls and in-person meetings. For example, we participated in the joint WQGIT and modeling workgroup meeting in December 2017. At this, there were discussions on Phase 6 modeling tools, draft Phase III Watershed Implementation planning targets, determining the Bay's assimilative capacity. DOEE also participated in many technical workgroups (e.g., Land Use, Modeling, Wastewater, Point Source Data, Water Quality Trading, Integrated Trends Analysis Team, and Toxic Chemicals Workgroup), and took an active role in addressing issues that are specific to the District. DOEE reported on the DC specific 2016-2017 programmatic milestone final updates and drafting the 2018-2019 programmatic milestones. The milestones help document progress in reducing jurisdictional nutrient and sediment contributions to the Bay.

Bacteria TMDL Revisions

Between 2003 and 2004, Department of Energy & Environment (DOEE) developed and EPA approved a total of 25 fecal coliform based-bacteria TMDLs for the District. These TMDLs needed to be revised by expressing the load allocations in "daily" terms (Friends of the Earth v. EPA 446 F.3d 140 (D.C. Cir. 2006)). They also required translation from fecal coliform to *E. coli* following DOEE's 2008 adoption of *E. coli* as the bacteria water quality criteria.

On July 25, 2014, EPA approved the Anacostia bacteria TMDLs covering the Anacostia River and tributaries, . The Potomac River Bacteria TMDL was approved on December 31, 2014. On 01/13/2017, EPA issued a revised approval of the Potomac River Bacteria TMDL, with further clarifying language, thus completing all the bacteria TMDL revisions as required by the consent decree. All the approved revised bacteria TMDLs are available on DOEE's website.

On November 23, 2015, DC Water filed a lawsuit in the United States District Court for the District of Columbia against the EPA challenging the revisions. In the lawsuit DC Water seeks to correct what it perceives as "technical mistakes...that may force unreasonable mandates on its Blue Plains Wastewater Treatment Facility." Specifically, DC Water is seeking corrections to the TMDL for E. coli. On August 15, 2016, the Anacostia RiverKeeper, Kingman Park Civic Association, and Potomac RiverKeeper (Plaintiffs) Network filed a lawsuit in the United States District Court for the District of Columbia against EPA also challenging the revisions. In the lawsuit, the plaintiffs argue that the TMDLs are missing loads to meet the single sample value criterion. Since that time, DC water withdrew its lawsuit after EPA clarified the TMDL; the other petition is ongoing.

Toxic TMDLs Revisions

In 1988, the District listed a number of waterbodies for toxics on its 303(d) list, for which TMDLs were subsequently developed. These TMDLs needed to be revised by expressing the load allocations in "daily" terms pursuant to Friends of the Earth v. EPA 446 F.3d 140 (D.C. Cir. 2006).

DOEE worked with EPA and LimnoTech on the Rock Creek metals TMDL revisions. The revised draft Rock Creek metals TMDL was approved by EPA on November 3, 2016.

DOEE also worked with EPA and the Interstate Commission on the Potomac River Basin (ICPRB) on PCB TMDLs in Rock Creek tributaries and pesticide TMDLs in the Potomac River and Rock Creek tributaries. The revised draft Potomac and Rock Creek TMDLs were approved by EPA on December 6, 2016.

After a detailed review of the Anacostia River watershed toxic TMDLs, EPA, DOEE and Maryland Department of Environment (MDE) determined that more data would be needed to achieve required revisions.

EPA contracted with Tetra Tech, Inc. to assemble all the available data and develop a database of relevant watershed data, undertake a data gap analysis, and incorporate recent sampling conducted by DOEE as part of the Remedial Investigation. Following all of these, it was determined that additional data was needed. Consequently, EPA placed a request through the Department of Justice (DOJ) for an extension of the court deadline until 2020. This extension was granted. In September 2017, EPA provided DOEE with additional grant funding to support monitoring work to commence in spring 2018. In addition, EPA issued a quality assurance plan for data collection and published a request for proposals in December 2017, to complete work

(e.g., model development). Currently, EPA, MDE, and DOEE are participating in regular conference calls and undertaking work to support TMDL development.

Anacostia Trash TMDL

The Anacostia Trash TMDL was approved by the EPA in 2010. In 2016, after unsuccessfully petitioning DOEE and MDE to revise the trash TMDL, the Natural Resources Defense Council (NRDC) filed an action challenging EPA's approval of the TMDL. In March 2018, the District Court decided that EPA lacked the authority to approve the TMDL because the TMDL was expressed as a reduction or removal of trash rather than as a maximum. The effect of the decision is that the existing TMDL remains in effect until a replacement TMDL is established and/or approved. The court did not set a deadline. EPA is currently reaching out to both MDE and DOEE to discuss next steps.

Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act § 303(d) Program" (Vision)

On December 5, 2013, EPA announced a new collaborative framework to manage program responsibilities and to identify and prioritize waterbodies for restoration and protection, entitled *A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act § 303(d) Program*. This Vision has six pillars (engagement, prioritization, protection, integration, alternatives and assessment). DOEE was required to develop separate strategies for "*engagement*" and "*priorities*" in the context of the District's overall water quality goals and values. The District's *Stakeholder Engagement Strategy* and *Prioritization Strategy* documents were finalized and incorporated as part of the revised 2016 Integrated Report. The revised 2016 Integrated Report was approved by EPA on February 2, 2017.

Training and Meetings/Conferences Attended:

DOEE continues to participate regularly in national and regional meetings, conference calls, and trainings including the following:

1. Chesapeake Bay Water Quality Steering Committee/Water Quality Goal Implementation Team, including other related Chesapeake Bay TMDL workgroups, namely: Land Use, Modeling, and Wastewater.
2. Chesapeake Bay Program's (CBP) Science and Technical Advisory Committee's (STAC) workshops on topics such as explaining water quality changes and support for mid-point assessment and future modeling efforts.
3. Specialized modeling courses (HSPF, BASINs, etc.) and other EPA sponsored webinars.

(3) Groundwater Protection

Summary

For several years, the Groundwater Pollution Prevention (GWPP) Program has been conducting

a hydrogeological study of the lower Anacostia Watershed in cooperation with the United States Geological Survey (USGS). The results of this ongoing work were presented to the EPA in annual summary reports and several USGS publications. Data from the existing monitoring network and the publications also are made available to the public through the DOEE and USGS websites.

DOEE and USGS are preparing to sign a Joint Funding Agreement (JFA) for FY 2018, using funds from the § 604(b) grant to perform the following activities:

1. Continue to maintain and collect data from the groundwater monitoring network. This work will include rehabilitating several deep wells to ensure that they can be sampled, and identifying possible sites and costs for installing up to three deep monitoring wells.
2. Publish monitoring data in the USGS Annual Water Data Report and make this information available to the public on the USGS website.
3. Submit a summary report to the GWPP at the end of FY 2018.

If additional funds become available from the 106 grant, both parties also will either modify the JFA or sign a new JFA to:

1. Evaluate available water quality data to determine ambient chemical concentrations for different aquifers, and
2. Continue to investigate the paleochannels of the Anacostia River and nearby geologic conditions to determine if and how they impact groundwater flux to the waterbodies. This work is subject to the availability of the principal investigator.

DOEE funding will be obtained from several sources including the § 604b grant ($60,000) and the § 106 grant ($40,000). USGS will perform the work and partially provide matching funds of at least 10,000.

GWPP continues to provide regulatory oversight at various facilities such as, Joint Base Anacostia-Bolling (JBAB). Other facilities covered by the Program include the Spring Valley formerly used Defense Site, Washington Gas, the South Capitol Street Bridge project, Capitol Crossing Project, the Ballpark Stadium, and several Department of General Services properties. Environmental Impact Screening Forms (EISF) and environmental assessments also were reviewed for groundwater issues.

DOEE reviewed and approved 201 private space permits. Nine public space permits were reviewed and approved.

A Well Guidance Document continues to be prepared. A draft version was circulated within DOEE for internal comments and the document is being revised. There is an ongoing discussion to update the ground water quality standards.

When necessary, the WQD coordinates with the programs responsible for NPDES permits and US Army Corps of Engineers Nationwide Permits for construction in wetlands and navigable

waters. On-going coordination also occurs with other Divisions for well permits requested at contaminated groundwater sites and Planned Unit Developments. The Program provided comments on technical guidelines for conducting groundwater characterizations at contaminated sites where construction dewatering is expected and reviewed workplans and reports for several projects. Comments were submitted on the Anacostia River Sediment Project Preliminary Remediation Goals Memorandum and the Anacostia River Sediments remedial investigation report. The GWPP also assisted the Energy Program with a proposal to map the District's geothermal potential.

The Program continues to interact with other states, the International Ground Source Heat Pump Association, and other District agencies with projects involving groundwater and environmental groups.

The Program coordinated with various entities regarding well permitting issues, well maintenance, water use, groundwater and surface water monitoring and contaminant investigations.

The Program responds to queries from the general public on a variety of groundwater issues. Assistance also is provided with presentations to citizen's groups.

The GWPP continues to provide grant management, as necessary.

Groundwater Modeling

To enhance protection of groundwater resources, various modeling activities were conducted including:

- Completion of a plan to address groundwater modeling in the District;
- Groundwater Vistas V.7 was selected and it is currently in use as a suitable Graphical User Interphase (GUI) Software for the use of MODFLOW, MT3D, MOTHPATH and ZONE BUDGET modeling codes;
- STRATER and VOXLER from Golden Software, were selected and they are in use for management of boring logs, cross section construction, and visualization of 3D Geological and Conceptual Hydrogeological Models;
- The Anacostia Watershed Groundwater Model made by the USGS was adapted to run on Groundwater Vistas and also to run in the USGS software MODELMUSE. The results of this regional model were considered to define the boundary conditions of the new DC Groundwater Model;
- The preliminary version of a detailed 3D flow and transport model for the Bolling Air Force Base, was used for understanding the degree of complexity of the groundwater system, parameter collection of hydrogeologic units, and understanding the interaction of groundwater with the Potomac River; and
- On-going development of a MODFLOW 3-D groundwater flow and transport model for the Tidal Anacostia River in DC, based on the adaptation of the existing Anacostia Watershed Groundwater Model made by the USGS, and the understanding of the

groundwater system. The model layers and parameters have been refined using DOEE's large collection of existing boring logs and all available hydrogeological information for the District.

(4) Compliance

Background

There are ten (10) facilities in the District that have individual permits issued by EPA under the National Pollutant Discharge Elimination System (NPDES) program. DC Water's waste water treatment plant (WWTP) continues to be the major discharger. The WWTP, along with other industrial NPDES permitted facilities, are inspected to insure compliance with permit conditions and the District's water quality standards (WQS). Table 1 lists the individual NPDES permitted facilities in the District.

In addition to NPDES individual permitted facilities, there are several industrial facilities and construction sites that have been permitted under a Multi-Sector General Permit (MSGP), or a Construction General Permit (CGP).

Table 1
NPDES Permitted Facilities in the District of Columbia

Permittee/Facility	Permit No	Type of Facility	Effective Date	Expiration Date
The Washington Aqueduct	DC0000019[¥]	Major	10/20/2008	11/19/2013
Potomac Electric Power Company (PEPCO), Benning Road	DC0000094[¥]	Major	6/19/2009	6/18/2014
D.C. Water and Sewer Authority (DC Water), Blue Plains AWTP	DC0021199[¥€]	Major	9/30/2010	9/30/2015
Government of the District of Columbia – MS4	DC0000221[¥€]	Major	10/07/2011	10/07/2016
CMDT Naval District Washington, DC	DC0000141[¥]	Minor	1/22/2010	1/22/2015
National World War II Veterans Memorial	DC0000345[¥]	Minor	5/01/2010	4/30/2015
Super Concrete Corporation	DC0000175	Minor	1/06/2014	1/05/2019
John F. Kennedy Center for the Performing Arts	DC0000248	Minor	6/06/2013	6/05/2018
Washington Metropolitan Area Transit Authority (WMATA)	DC0000337[¥]	Minor	4/20/2012	4/20/2017
General Services Administration (GSA)-NCR HOTD (West Heating Plant)	DC0000035[¥]	Minor	5/25/2012	5/24/2017

Note:
[¥] EPA has administratively extended the permit under 40 CFR 122.6(a)(1).
[€] A draft permit has been issued for public comments and the permit has not yet been finalized.

Review and Certification of Draft EPA NPDES Permits

The District is not a delegated state under EPA's NPDES program and therefore does not issue discharge permits. Draft individual and general NPDES permits prepared by EPA are reviewed for certification by WQD for completeness and compliance with both federal and District laws and WQS, in accordance with § 401 of the Clean Water Act. WQD may require revisions to the

draft permit in order to comply with more stringent District laws and standards. Changes in draft permits may also incorporate comments received from various stakeholders during the public comment period, the announcement of which is made in one or more of the District's local newspapers. The announcement for public comments is a joint venture by both EPA and the District. Final permits are issued for a five year period, but contain re-opener clauses in case facility conditions, WQS, or regulations change.

There are eight (8) facilities whose individual permits have expired and EPA is in the process of either reviewing the permit renewal applications, or drafting renewal permits. DOEE continues to work cooperatively with EPA on the NPDES permits that are currently being drafted for reissuance. DOEE stays engaged with EPA on local water quality and permitting matters which is invaluable as EPA continues to implement the NPDES program in the District. The permits that have expired are listed in Table 1. After drafting the permits, EPA requests WQD to review and certify the draft permits in accordance with § 401 of the CWA. WQD received one draft individual NPDES permit for comment and certification (NPDES Permit Number DC0000221 for the District of Columbia's MS4). WQD waived its right to issue a § 401 water quality certification.

WQD received the following draft NPDES permits for review and comment; and WQD submitted and or discussed the comments with EPA:

1. NPDES Permit Number DC0000221 - Government of the District of Columbia – MS4;
2. NPDES Permit Number DC0021199 - D.C. Water and Sewer Authority (DC Water), Blue Plains AWTP;
3. NPDES Permit Number DC0000035 - Georgetown 29K Acquisition LLC [former General Services Administration (GSA)-West Heating Plant];
4. NPDES Permit Number DC0000345 - National World War II Veterans Memorial; and
5. NPDES Permit Number DC0000370 - Lincoln Memorial Reflecting Pool.

INSPECTION AND ENFORCEMENT DIVISION
ILLICIT DISCHARGES & NPDES BRANCH

(1) Inspection and Enforcement

DOEE conducts compliance inspections of facilities that have been issued an NPDES permit including: Major and Minor Individual Permits and MSGP. Compliance inspections are recognized as a vital part of the District's NPDES program. Appropriate enforcement actions are recommended to EPA for violations and/or deficiencies observed during the inspections. Deficiencies that do not require a formal enforcement action are handled at the time of the inspection.

The objective of the NPDES Compliance Inspection Program (CIP) is to provide a level of inspection coverage necessary to assess permit compliance and develop enforcement documentation, where warranted. The District's NPDES CIP generally conducts Compliance Evaluation Inspections (CEI), but may perform Compliance Sampling Inspections (CSI), if required. The CEI is an inspection designed to verify a permittee's compliance with applicable permit effluent limits, self-monitoring and reporting requirements, and compliance schedules. A CEI involves report and records reviews; visual observations of the facility; and evaluation of the treatment systems, effluent, receiving waters and disposal practices. An inspection may be a sampling inspection in which samples are collected.

Table 2 lists the NPDES Permitted facilities that have been inspected during this period.

Table 2
Facilities

Permittee/Facility	Permit No	Permit Status
CMDT Naval District Washington DC	DC0000141	Active
NPS – Rock Creek – Maintenance Yard	DCR050001	Active
WMATA – Western Bus Division	DCR053009	Active
Roubin and Janeiro Asphalt Plant	DCR053047	Active
District Yacht Club	DCR052010	Active

Plan and Focus Resources on the Most Significant Sources of Water Quality Impairment

EPA Region 3 and WQD plan and develop an annual Compliance Monitoring Strategy (CMS) to identify and plan inspections of potential significant sources of water quality impairment. The CMS identifies inspections within the District of both individually permitted facilities for the discharge of wastewater and general permitted facilities for the discharge of industrial stormwater. Annual CMS Report for FY 2017 and the proposed CMS for FY 2018 were submitted to EPA during this reporting period.

From October 1, 2017 to March 31, 2018, DOEE WQD implemented the FY 2018 CMS and conducted CEIs of the facilities listed in Table 2, above.
Inspection and Enforcement Activities covered by the General Permit for Dischrages from

Construction Activities (Construction General Permit).

DOEE conducts inspections of construction activities with erosion and sediment control plans that have been approved by DOEE. Many of these activities also have coverage under the Construction General Permit. Currently, no special initiatives or best management practices are being deployed for inspection and enforcement of these activities. Furthermore, no signigicant impediments are present which would prevent the inspection program from reaching it's commitments as defined in the FY18 CMS.

REGULATORY REVIEW DIVISON
WATER RESOURCE PROTECTION AND MITIGATION BRANCH

Review and Certification of § 404 Permits (Wetland Protection)

In accordance with § 401 of the CWA, DOEE Regulatory Review Division (RRD) reviews and certifies permits issued by the U.S. Army Corps of Engineers, Baltimore District (USACE) under § 10 of the Rivers and Harbors Act of 1899 and/or § 404 of the CWA, as published in the February 21, 2012 Federal Register, Final Notice of Issuance, Reissuance, and Modification of Nationwide Permits (NWPs)(72 FR 11090).

The District has a policy of no net loss of wetlands, stream areas, and functions within its jurisdictional boundaries. To achieve this goal, RRD reviews all activities and construction projects that may have the potential to impact wetlands and streams in the District. USACE issues dredge and fill permits after making a jurisdictional determination with regard to what constitutes "waters of the United States" including jurisdictional wetlands. RRD reviews the delineation report, jurisdictional determination, and permit issued by USACE for completeness and compliance with both Federal and the District's laws, including the District's WQS. Based on the results of the review, RRD may issue its own jurisdictional determination and certify or deny certification of the USACE permit. Wetlands that do not fall under Federal jurisdiction may still fall under the jurisdiction of the District.

Although the purpose of the review process is to avoid and minimize impacts, it is anticipated that some projects that impact wetlands and streams may be allowed to proceed. These include water dependent projects and those for which there is no practicable alternative. Mitigation is always required for permanent impacts associated with these types of projects.

i. Mitigation of impacts to wetlands and streams are considered in accordance with the following sequence:
ii. Avoidance: Modification of the scope of the proposed activity, or construction to completely avoid the potential impacts to the wetland or stream.
iii. Minimization: Minimization of the necessary impacting activity to the greatest extent practicable.
iv. Restoration: Rectifying the impact by repairing, rehabilitating, or restoring the affected wetland or stream following completion of the activity or construction.
v. Compensation: Compensating for the impact to the wetland or stream by creating or enhancing an alternative wetland/stream.

Table 3 lists the projects reviewed or certified by RRD.

Table 3
Dredge and Fill Permits reviewed and certified by RRD

Certification Number	Permittee	Project Description
WQC-DC-017-004A (Modification)	District Department of Transportation (DDOT)	Modification request to place two cofferdams in the C&O Canal.
WQC-DC-017-021, and WQC DC-017-021A	DC Water	Stream restoration at Hickey Run, National Arboretum, Washington, DC.
WQC-DC-17-022	DDOT	To conduct sediment sampling in the Anacostia River near the South Capitol Street Bridge.
Jurisdictional Determination	DDOT/HNTB	Jurisdictional determination (JD) and verification of the delineation of waters of the District of Columbia, including wetlands within the South Capitol Street Bridge Improvements project area.
Modified DC-18-001 (formerly WQC-DC-17-003)	DDOT	To demolish the existing South Capitol Street Bridge, remove the piers, and install a new bridge in the Anacostia River adjacent to the old bridge footprint.
WQC-DC-18-002	Century Link	To install by horizontal directional drill under the Anacostia River, approximately 60 feet below the river bottom, 1,340 linear feet of 6-inch steel drill casing, equipped with (3) 1.25-inch SDR 13.5 HDPE innerducts with one duct containing 1,340 linear feet of fiber optic cable.
Consultation	Straughan Environmental, Inc.	Repairs to the Arlington Memorial Bridge in the Potomac River, Washington, DC.
WQC-DC-18-003	Straughan Environmental, Inc.	To perform geotechnical borings in the Potomac River, near the Arlington Memorial Bridge.
WQC-DC-18-004	US Army, Ft. McNair	Seawall repairs at Ft. McNair, Washington, DC.
WQC-DC-18-005	Johnson, Mirmiran & Thompson, Inc.	To perform repairs to the existing Key Bridge, in the Potomac River, Washington, DC.
WQC-DC-18-006	Tetra Tech/DOEE	To perform sediment characterization within the Fletcher's Cove, in the Potomac River, Washington, DC.
WQC-DC-018-007	Anacostia Watershed Society	To install a temporary floating platform for the Anacostia River Festival, in the Anacostia River.

Certification Number	Permittee	Project Description
WQC-DC-018-008	Anacostia Watershed Society	To install a temporary floating dock in the Anacostia River, at the National Arboretum.
Consultation	DC Water/AECOM	To restore temporary impacts to a wetland in Anacostia Park adjacent to the 11th Street Bridge.
Consultation	DC Department of Parks and Recreation (DPR)	Consultation regarding proposed improvements to Carolina Park, in Northwest Washington, DC.
Consultation	Douglas Development Corporation	Consultation regarding permitting requirements.
Consultation	CAS Engineering, DC, LLC	Performed a site visit to answer questions regarding a stream and wetland located on single family home owner's property.
Consultation	JBAB	To perform repairs to the seawall at JBAB.
Consultation	Ocean Construction Services, Inc.	Consultation regarding proposed repairs an existing pier at Naval Research Laboratory.
Consultation	DC Water	Consultation regarding permitting requirements for emergency outfall repairs at Gallatin Street and 14th Street NE, Washington, DC.

WATER QUALITY DIVISON
MONITORING AND ASSESSMENT BRANCH

A. Management

The Monitoring and Assessment Branch (MAB) prepared its calendar-year 2018 monitoring schedule to coincide with MWCOG's regional monitoring subcommittee timetables.

Monitoring staff continued to represent the District of Columbia on relevant Chesapeake Bay Program subcommittees and workgroups. Monitoring staff also attended the MWCOG Regional Monitoring Committee meeting, in November 2017. Participation in these meetings facilitates the coordination of some of the Branch's activities with regional water quality monitoring groups.

B. Ambient Monitoring

(1) Sample Collection

During this grant year, MAB collected samples at the stations in its ambient water quality monitoring network. Samples were collected as scheduled (See Table 4). The number of water samples collected through March 2018 totaled one thousand two hundred twenty-five (1,225). Nine hundred twenty-three (923) of these samples were delivered to the MAB laboratory at Fort Meade for analysis, one hundred ninety-two (192) were delivered to the MAB laboratory at Blue Plains WWTP and one hundred ten (110) biological samples were preserved and stored for delivery to a contractor for taxonomic identification (Tables 5 and 7). MAB is working with the Office of Contracts and Procurement on an invitation for bids to conduct analyses of benthic macroinvertebrate, phytoplankton and zooplankton samples.

Table 4
FY 2017 Sample Collection Dates
October 2017 – March 2018

Potomac River	Anacostia River	Combined Run[#]	Anacostia Tributaries	Northwest Tributaries
Oct 10 17	Oct 16 17	Oct 23 17	Oct 02 17	Oct 03 17
Nov 06 17	Nov 07 17	Not Scheduled[#]	Nov 13 17	Nov 14 17
Dec 11 17[*]	Dec 12 17	Not Scheduled [#]	Dec 04 17	Dec 05 17
Jan 08 18	Jan 09 18	Not Scheduled [#]	Jan 02 18	Jan 16 18
Feb 12 18	Feb 13 18	Not Scheduled [#]	Feb 05 18	Feb 06 18
Mar 12 18[*]	Mar 13 18	Mar 19 18	Mar 05 18	Mar 06 18

[*] Coordinated split sample collection date
[#] Samples are not collected during the months of November to February

Table 5
Number of Water Samples Collected and Number of Analyses Performed in the First Quarter of FY 2017

Date	Sampling Run	No. of Water Samples Collected			No. of Analyses Performed
		MAB (Ft. Meade)	MAB (Blue Plains)	BIO	MAB (Ft. Meade)
OCT 2 17	Anacostia Tribs	46	7	3	119
OCT 3 17	Northwest Tribs	33	4	2	106
OCT 10 17	Potomac River	41	8	8	94
OCT 16 17	Anacostia River	51	12	8	129
OCT 23 17	Combined Run	13	6	0	19
NOV 6 17	Potomac River	34	8	6	48
NOV 7 17	Anacostia River	42	12	7	49
NOV 13 17	Anacostia Tribs	37	7	3	69
NOV 14 17	Northwest Tribs	27	4	2	69
DEC 4 17	Anacostia Tribs	39	7	3	78
DEC 5 17	Northwest Tribs	29	4	2	78
DEC 11 17	Potomac River	40	11	6	51
DEC 12 17	Anacostia River	42	12	7	57
SUB-TOTALS		**474**	**102**	**57**	**966**

Table 6
Number of Water Samples Collected and Number of Analyses Performed in the Second Quarter of FY 2017

Date	Sampling Run	No. of Water Samples Collected			No. of Analyses Performed
		MAB (Ft. Meade)	MAB (Blue Plains)	BIO	MAB (Ft. Meade)
JAN 2 18	Anacostia Tribs	42	7	3	116
JAN 8 18	Potomac River	33	6	4	86
JAN 9 18	Anacostia River	30	6	6	83
JAN 16 18	Northwest Tribs	33	4	2	110
FEB 5 18	Anacostia Tribs	37	7	3	69
FEB 6 18	Northwest Tribs	27	4	2	69
FEB 12 18	Potomac River	30	7	5	43
FEB 13 18	Anacostia River	36	9	7	51
MAR 5 18	Anacostia Tribs	39	7	3	78
MAR 6 18	Northwest Tribs	29	4	2	78
MAR 12 18	Potomac River	40	11	6	61
MAR 13 18	Anacostia River	42	12	7	157
MAR 19 18	Combined Run	13	6	3	24
SUB-TOTALS		**431**	**90**	**53**	**1025**
GRAND TOTALS		**905**	**192**	**110**	**1991**

Table 7
Number of Water Samples Collected and Number of Analyses Performed in the Second Quarter of FY 2018
Additional *E. coli* Monitoring

Date	**Sampling Run**	**No. of Water Samples Collected**	**No. oOf Analyses Performed**
		MAB (Ft. Meade)	**MAB (Ft. Meade)**
MAR 06 18	E. Anacostia	6	6
MAR 19 18	Comb. Run w/E.	6	6
MAR 27 18	E. Anacostia	6	6
TOTALS		**18**	**18**

(2) Sample Processing and Laboratory Analysis

MAB staff performed two thousand nine (2,009) separate analyses on collected samples.

(3) Biological Sampling

The monitoring program has continued to collect surface phytoplankton samples at selected stations. Since July 1990, the WQD, Monitoring and Assessment Branch (MAB) has collected zooplankton samples based on its revised zooplankton sampling protocol. Two stations on the Potomac River and one station on the Anacostia River have been sampled on a monthly basis, using the revised protocol. The MAB's biological sampling period is from March to August. The benthic macroinvertebrate collection and spring habitat assessment period is from March through May. The summer fin-fish habitat assessment and fin-fish identification process is conducted from June through August.

The primary purpose for conducting a stream survey assessment is to allow a cost effective method of assessing the habitat, fishability and biological integrity of streams and rivers in the District. Twenty-five tributaries are scheduled to be sampled for the biological stream survey. Three core streams are sampled yearly. The remaining twenty-two streams are separated into first and second rounds of streams. The first round streams are sampled on even calendar years and the second round streams are sampled on the odd calendar years. This annual rotation allows all District streams to be sampled once every two years for biological parameters, with the three core streams being sampled annually.

The 2018 District of Columbia Stream Survey (DCSS) is scheduled to sample the three core streams, Watts Branch (upper/lower), Hickey Run and, Rock Creek (upper/lower), and the first round stations, Battery Kemble Creek, Fort Chaplin Tributary, Fort Davis Tributary, Fort Dupont Creek, Foundry Branch, Luzon Branch, Melvin Hazen Valley Branch, Oxon Run, Piney Branch, Portal Branch, Soapstone Creek, and Texas Avenue Tributary.

During this period, four streams have been sampled.

(4) Coordinated Split Sampling Program

MAB staff continued to collect and prepare the split sample for the tributaries sampling analyses programs in Maryland and Virginia. MAB also participated in the analysis of split sample program. MAB has collected two split samples during this reporting period (See Table 8).

Table 8
Split Sample Collection Dates

Date	Tributary/Station
Monday, December 11, 2017	Potomac PMS 10

Date	Tributary/Station
Monday, March 12, 2018	Potomac PMS 10

(5) Continuous Monitoring

The real time monitoring units take a reading every 15 minutes (Table 9). The parameters measured are temperature, dissolved oxygen, pH, specific conductivity, turbidity, and chlorophyll. The readings are used to form a database from which the MAB can make water quality assessments, and calibrate and compare data for the total maximum daily load models (TMDLs) being developed by the WQD.

The water quality probes are periodically cleaned and calibrated to prevent drift and to follow QA/QC protocol. During winter months the sonde units are removed from service to protect the equipment. They are redeployed in the spring.

The real-time monitoring data is available via the DDOE web site using the YSI® sondes through the Xylem Storm Central Water Log system.

Table 9
Real-time Monitoring Stations and Dates

Station ID	2017	2018
Upper Anacostia River (ANA08)	10/01-12/12	Not deployed-under service
Lower Anacostia River (ANA21)	10/01-12/12	Redeployed 03/22
Upper Potomac River (PMS 13)	10/01-12/11	Redeployed 03/22

(6) Non-tidal Monitoring Network

The FY 2018 JFA between DDOE and USGS to expand the non-tidal monitoring parameters to include trace metals, mercury, and *E. coli* has been executed. The non-tidal monitoring stations are on Rock Creek, Watts Branch and Hickey Run. The data will be used to establish trends and for consideration when developing future 303(d) list. The metals' QAPP is provided as an attachment to this document (QCM_v1.0.pdf). The QAPP associated with *E. coli* is found at https://www.chesapeakebay.net/what/programs/chesapeake_bay_quality_assurance_program/quality_assurance_nontidal_water_quality_monitoring.

C. The District of Columbia Integrated Report (IR)

The submission of the draft 2018 IR has been delayed, due to issues with the new ATTAINS system.

D. Fish Tissue Sampling from the District of Columbia Rivers

WQD and FWD transferred fish samples to US Fish and Wildlife Service (FWS). The FWS has processed fish samples and analysis is underway. The project is expected to be completed in July 2018. The QAPP is provided as an attachment to this document (US FWS QAPP.pdf).

E. Trainings and Meetings/Conferences Attended:

During this reporting period, the MAB has been involved in several projects/collaborations, they include:

- Non-Tidal Workgroup conference calls for non-tidal monitoring stations on Hickey Run, Watts Branch and Rock Creek;
- 2017 National Water Quality Data Management Training Workshop; and
- Science & Technical Analysis & Reporting (STAR) team.

F. Data Management

The MAB regularly updates data files. When finalized, the files are transmitted through a protocol set forth by the Chesapeake Bay Program and EPA's Water Quality Exchange Web guidelines. Data on the WQD database shown in the WQX Web column in Table 10 has been processed through the WQX Web database. All data submissions are listed in Table 10.

Table 10
Data Submissions

Data Processed	Monitoring and Assessment Branch	CBP Program Transmittal	WQX Web
Potomac River Nutrients	JUL-DEC 17 JAN-MAR 18	DEC 17	JUL-DEC 17
Potomac River Field	JUL-DEC 17 JAN-MAR 18	DEC 17	JUL-DEC 17
Anacostia River Nutrients	JUL-DEC 17 JAN-MAR 18		JUL-DEC 17
Anacostia River Field	JUL-DEC 17 JAN-MAR 18		JUL-DEC 17
Anacostia Tributary Nutrients	JUL-DEC 17 JAN-MAR 18		JUL-DEC 17
Anacostia Tributary Field	JUL-DEC 17 JAN-MAR 18		JUL-DEC 17
Northwest Tributary Nutrients	JUL-DEC 17 JAN-MAR 18		JUL-DEC 17
Northwest Tributary Field	JUL-DEC 17 JAN-MAR 18		JUL-DEC 17

The MAB received and processed 19 water quality data requests.

G. Water Quality Analysis

Surface water quality analysis for various parameters on ambient samples collected by MAB staff were conducted by MAB staff located at EPA's Environmental Science Center (ESC), in Ft. Meade, MD. The samples that are delivered to the ESC continue to be handled with strict adherence to the necessary protocols and maintenance of the integrity of the chain of custody. Samples were analyzed for physical, chemical, and biological parameters in accordance with Standard Methods. The data were recorded and quality assured and were forwarded to MAB staff at 1200 First St., NE Washington, DC, for entry into the database. A total of two thousand nine have been analyzed thus far for fiscal year 2018. Details of the samples analyzed are given in Table 11. The quality of the analyses performed was checked using established QC/QA procedures.

Table 11

Total Samples Processed by MAB (Ft. Meade) in FY 2018						
	Nutrients	Metals	BOD_5	TSS	Micro	Total
Oct 2017	72	288	26	37	44	467
Nov 2017	77	64	27	31	36	235
Dec 2017	84	80	27	34	39	264
Jan 2018	69	256	22	23	25	395
Feb 2018	79	64	26	27	36	232
Mar 2018	212	80	27	40	57	416
Grand Total	593	832	155	192	237	2009

Work Plan

Goal 2: Clean and Safe Water			
Objective 2: Protect Water Quality			
Sub-objective 2.2.1: Improve Water Quality on a Watershed Basis			
Work Plan Component/Program: Compliance/Inspection/Enforcement Workyears:	EPA Contact: Ingrid Hopkins/Kelly Somers	District Contact: J. Rodriguez	Program Result Code (PRC): 202B06
Program Description: The WQD staff performs inspections of NPDES permitted facilities to ensure authorized wastewater discharges are being handled and managed according to their permit requirements and sources of stormwater pollution are eliminated or reduced according to the permit conditions. WQD staff also maintains an aggressive illicit discharge detection elimination program to prevent the unauthorized discharge of pollutants to the District's MS4 and District Waters. When warranted appropriate enforcement actions are taken to address and eliminate the illicit discharges.			
Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs for FY- 2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
Reduce pollution to surface waters	**WQ-15a and b**: Percent of major dischargers in Significant Noncompliance (SNC) at any time during the fiscal year, and of those, the number, and national percent, discharging pollutant(s) of concern on impaired waters.	Conduct NPDES compliance evaluation inspections at 100 percent of Major individually permitted facilities within 50 percent of the Minor individiually permitted facilities in the District. Conduct compliance evaluation inspections at 10 percent of the NPDES Multi-Sector General Permit (MSGP) facilities within the District. Within 30 days upon inspection, finalize the NPDES compliance evaluation inspection reports and submit them to NPDES Enforcement Branch Chief (3WP42) or designated authority. Submit the District's NPDES Compliance Monitoring Strategy reflecting the above proposed inspection goals, no later than December 31, 2017. **Activities:** Investigate illicit discharges to District waters and conduct appropriate enforcement action as necessary in	1. DOEE has conducted CEIs for the minor individually permitted CMDT Naval District Washington DC (Navy Yard) - DC0000141 (03/27/18). 2. DOEE has conducted four (4) industrial stormwater CEIs from October 1, 2017 through March 30, 2018. These facilities include NPS – Rock Creek Park – Maintenance Yard – DCR050001 (12/21/17), WMATA – Western BDus Division – DCR053009 (12/18/17), Roubin and Janeiro Asphalt

		coordination with US EPA.	Plant – DCR053047 (01/08/18), and District Yacht Club – DCR052010 (01/11/18). 3. All CEI reports have been finalized and submitted or will be submitted to EPA Region 3 NPDES Enforcement Branch. 4. The District of Columbia NPDES Final Compliance Monitoring Strategy Report Federal Fiscal Year 2017 and the FY2018 Proposed Compliance Monitoring Strategy were submitted in October 2017. 5. From October 2017 through March 2018 DOEE IED investigated 35 illicit discharge reports to District Waters or the MS4. DOEE has issued several Notices of Infraction and is currently drafting several additional enforcement actions.

Goal 2: Clean and Safe Water			
Objective 2: Protect Water Quality			
Sub-objective 2.2.1: Improve Water Quality on a Watershed Basis			
Work Plan Component/Program: TMDLs Workyears:	EPA Contact: Michelle Peck	District Contact: J. Seltzer	Program Result Code (PRC): 202B06
Program Description: DOEE Water Quality Division/TMDL Program - Development of TMDLs are the core planning activities of the Water Quality Division. Most of the District's waterbodies are listed as impaired in the District's 303(d) list. WQD has developed over 350 TMDLs over the last several years. WQD staff use a range of tools to develop TMDLs based on various water quality and watershed information. Staff also manage contracts, provide contract support, coordinate various public outreach activities, attend meetings, review and comment on water quality assessment studies, and write TMDL reports.			
Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs for FY-2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
TMDLs are an integrated part of the District's water quality management planning (WQMP). This planning effort is part of the District's overall WQMP and will provide a roadmap for restoration of impaired waters in the District. The resulting outcome will be improved water quality in the District.	**WQ-21:** Number of water segments identified as impaired in 2002 for which States and US EPA agree that initial restoration planning is complete (i.e., US EPA has approved all needed TMDLs for pollutants causing impairments to the waterbody or has approved a 303(d) list that recognizes that the waterbody is covered by a Watershed Plan (i.e., Category 4b or Category 5m). WQ-27: The extent of priority areas identified by each State that are addressed by EPA-approved TMDLs or alternative restoration approaches for impaired waters that will achieve water quality standards. These areas may also include protection approaches for	**Output:** Develop and submit TMDL plans targeted for FY 2018. **Activities:** Review policy and technical documents to: 1. Finalize work on the DC based geo-spatial data and information that meets federal geospatial data standards. 2. Continue coordination with US EPA to address the remainder of the Consent Decree TMDLs (Toxics) in response to the July 25, 2011 U.S. District Court decision, including the on-going lawsuit on the Potomac River Bacteria TMDL. 3. Continue to provide technical support and coordination with US EPA on the Chesapeake Bay TMDLs in all aspects: Modeling, BMP verification, STAC, WQGIT, Technical Memoranda reviews, Land Use data review, etc.	1. Nearing completion; Spring 2018/Completing field verification and finalizing the draft geo-spatial data. 2. Ongoing/Court extended deadline until 2020. DOEE is working with EPA and MDE to develop TMDL for toxics in the Anacostia River 3. Ongoing/Attended WQGIT meetings and workshops. Reported on programmatic milesones. Participated in STAC meetings and workshops. 4. Ongoing/Recent decision by District Court on the Anacostia trash TMDL to replace the current TMDL. EPA, DOEE, and MDE are discussing next steps.

	unimpaired waters to maintain water quality standards. Complementary Measure (WQ-28): State-wide extent of activities leading to completed TMDLs or alternative restoration approaches for impaired waters, or protection approaches for unimpaired waters.	4. Continue collaboration with EPA Region 3 to implement the new Long-Term Vision goals and priorities for Section 303(d) of the Clean Water Act. Continue to implement the prioritization strategy developed under the 303(d) Vision strategy. It is EPA's expectation that all waters identified under the prioritization strategy will have a TMDL or TMDL alternative plan by the end of Fiscal Year (FY) 2022. a. In order of priority, TMDLs or TMDL alternative plans to be revised in FY18: 1. Those subject to court order deadlines or consent decree agreement(s); 2. TMDL projects in which DOEE's and EPA's national and/or regional priorities intersect and where opportunities for collaboration exist. b. For measure WQ-27, during 2018 DC will address 0 acres or 0 %, of its priority universe through a TMDL or alternative restoration plan. 5. Include in the 2018 IR: a. narrative describing progress towards implementation of EPA's *Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program*. The narrative should communicate the Vision Goals to the public and other stakeholders and encourage their participation in achieving them; provide information about the purpose and critical importance of the program; and encourage their participation in the process of listing and developing TMDLs or alternatives. b. a description of the prioritization strategy under the new 303(d) Vision that was used to identify your State's priority lists,	5. Ongoing/working towards including marratives, descriptions, and lists into the 2018 draft Integrated Report. 6. Ongoing/New monthly calls with EPA have been set up to help develop the TMDL for toxics in the Anacostia River.

		c. the list of priority waters with their schedule for likely TMDL, TMDL alternative, and/or Protection plans and approaches over 2018 – 2022, and any public participation opportunities throughout the prioritization process. d. A narrative description of the progress toward meeting the 2020 Assessment Goal, (review monitoring and assessment needs for future TMDL/TMDL alternative/protection plans developed in priority watershed and plan for additional monitoring as needed). 6. Participate on monthly calls as needed with EPA to discuss the development of the State's TMDLs/TMDL alternative/ protection plans, state priorities for TMDLs, and efforts to coordinate Section 303d program priorities with other relevant programs (e.g., monitoring, nonpoint source control and NPDES programs).	

Goal: Clean and Safe Water			
Objective: 2.2 Protect Water Quality			
Sub-Objective: Improve Water Quality on a Watershed Basis			
Work Plan Component: Permits	US EPA Contact: Carissa Moncavage, Stormwater-Elizabeth Ottinger, Wastewater-Mark Smith	District Contact: J. Seltzer	Program Result Code: 202B06
Program Description: WQD staff review draft US EPA issued permits for compliance with District Water Quality Standards, coordinates public review comments, and prepares certifications.			

Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs (activity or work product-qualitative or quantitative)	Status/Comment
Restoration of waterbodies and improved water quality.	**WQ-12a:** Percent of non-tribal facilities covered by NPDES permits that are considered current. **WQ-19b:** Number of high priority state and US EPA (including tribal) NPDES permits that are issued in the fiscal year. **WQ-13a & b:** Number, and national percent, of facilities covered under either an individual or general permit by type: a) MS-4s and b) industrial storm water.	**Output:** Issue water quality certifications for draft NPDES permits issued by U.S. EPA Region III. **Activities:** Review technical and regulatory aspects of draft permits for compliance with District of Columbia Water Pollution Control Act and implement regulations including Water Quality Standards. Discuss comments on draft permits with U.S. EPA Region III, the permittee, and other parties. Participate in coordination of public outreach.	WQD reviewed, provided and discussed with EPA comments for the following draft individual NPDES permits: 1. NPDES Permit Number DC0000221 - Government of the District of Columbia – MS4; 2. NPDES Permit Number DC0021199 - D.C. Water and Sewer Authority (DC Water), Blue Plains AWTP; 3. NPDES Permit Number DC0000035 - Georgetown 29K Acquisition LLC [former General Services Administration (GSA)-West Heating Plant]; 4. NPDES Permit Number DC0000345 - National World War II Veterans Memorial; and 5. NPDES Permit Number DC0000370 - Lincoln Memorial Reflecting Pool. WQD will issue water quality certifications for these individual permits once EPA submits the requests.

Goal 2: Clean and Safe Water			
Objective 2: Protect Water Quality			
Sub-objective 2.2.1: Improve Water Quality on a Watershed Basis			
Work Plan Component/Program: Water Quality Standards Workyears:	EPA Contact: Jillian Adair	District Contact: R. Diehl	Program Result Code (PRC): 202B06
Program Description: Water quality standards are required to be revised every three years to address the new information and priorities of national, regional and local stakeholders. WQD staff works with US EPA to identify the latest changes and policies that can be incorporated in District Water Quality Standards.			

Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs for FY- 2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
Improved conditions of water quality.	**WQ-1: a)** Number of numeric water quality standards for total nitrogen and for total phosphorus adopted by States and Territories and approved by US EPA, or promulgated by US EPA, for all waters within the States or Territory for each of the following waterbody types: lakes/reservoirs, rivers/streams, and estuaries (cumulative 280); and **b)** Number of numeric water quality standards for total nitrogen and for total phosphorus at least proposed by States and Territories, or by US EPA proposed rulemaking, for all waters within the States or Territory for each of the following waterbody types: lakes/reservoirs, rivers/streams, and estuaries (cumulative); c) Number of States and Territories supplying a full set	**Output:** Submit revised water quality standards package to address latest changes, including changes recommended by US EPA. **Activities:** Identify the latest changes in water quality standards recommended by US EPA. Prepare proposed revisions to water quality standards. Perform/coordinate technical and legal sufficiency revisions of proposed revisions to water quality standards. Coordinate rulemaking process and public outreach for the proposed changes to water quality standards. For FY17 the District plans to evaluate the following Water Quality Standards: 1) Prepare proposed revisions to water quality standards for triennial review 2016. 2) Begin review of the draft fish tissue criteria for selenium for possible inclusion in the next	1. The proposed Water Quality Standards package was published for a 90 day public comment period on September 15, 2017. Three public comments were received and one letter of support. 2. Research on the BLM model for copper water quality criteria recommendations, arsenic, chloride, and hardness was started. 3. Research on perchlorate as a water quality criteria was initiated. 4. Initiated review of non-conventional parameters and

	of performance milestone information to US EPA concerning development, proposal, and adoption of numeric water quality standards for total nitrogen and total phosphorus for each waterbody type within the State or Territory (annual). **WQ-3(a):** Number, and national percent, of States and Territories and authorized Tribes that within the preceding three year period, submitted new or revised water quality criteria acceptable to US EPA and reflect new scientific information from US EPA or other resources not considered in the previous standards. **WQ-SP-10.N11:** Number of waterbodies identified in 2002 as not attaining water quality standards where standards are now fully attained. (cumulative) **WQ-SP-11:** Remove the specific causes of waterbody impairment identified by states in 2002. (cumulative) **WQSP-12.N11**: Improve water quality conditions in impaired watersheds nationwide using the watershed approach. (cumulative)	review(2019). Begin review of the BLM model for copper water quality criteria recommendations, arsenic, chloride, and hardness in the next (2019) triennial review. 3) Begin research on possible inclusion of perchlorate into District's water quality standards. 4) Begin review of water quality criteria for non-conventional parameters and frequency of excursion "once in three years." 5) Update US EPA references and definitions in the regulations, as appropriate. <u>Region III States WQS Coordinators:</u> Participate in Region III states meetings to incorporate new scientific information and discuss issues with neighboring jurisdictions. Coordinate input from the stakeholders.	frequency excursion. 5. References and definitions were reviewed and updated in the proposed WQS. 6. Participated in the 2017 EPA/States Regional Forum and Training for NPDES, WQS, 303(d) Listing/TMDLs in October 2018. 7. DOEE is currently reviewing public comments on the 2016 Triennial Review proposed WQS and drafting contract documents for the socio-economic, institutional, technical, and environmental analyses.

Goal 2: Clean and Safe Water			
Objective 2: Protect Water Quality			
Sub-objective 2.2.1: Improve Water Quality on a Watershed Basis			
Work Plan Component/Program: Water Quality Monitoring Workyears:	EPA Contact: Bill Richardson/Kelly Somers	District Contact: N. Shulterbrandt	Program Result Code (PRC): 202B06
Program Description: WQD staff collect water samples at fixed station network. Physical tests are conducted in the field for temperature, DO, pH and other parameters. Water samples are delivered to ESC for analysis for bacterial, nutrient, and metals analyses. Stream surveys are also performed at selected waterbodies.			

Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs for FY- 2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
Number of District Watersheds where: water quality standards are met or improved in at least 80% of the assessed water segments; and all assessed water segments maintain their quality and at least 20% of assessed water segments show improvement above conditions in 2002.	**WQ-5:** Number of States and Territories that have adopted and are implementing their monitoring strategies in keeping with established schedules.	**Outputs:** Submit a report on the number of stream surveys conducted. Report the number of stations where fish tissue was sampled and the number of samples collected. Submit semiannual progress reports on the implementation of the monitoring strategy. Review, update, and submit appropriate quality assurance documents as required by US EPA and DOEE Quality Management Plan. **Activities:** Perform sample collections and collect field data at fixed station network sites. Enter quality assured water quality data into CIMS and WQX	1. Ambient monitoring samples continue to be collected at the fixed station network sites. 2. The Monitoring and Assessment Branch (MAB) continues to enter into the WQX database, using protocols established by the Chesapeake Bay Program. 3. US Fish and Wildlife Service (FWS) was selected to conduct the fish tissue study for the District. The fish samples have been transferred to FWS. According to FWS's most recent status update the fish

		or databases using established protocols. Coordinate and monitor the progress of the special studies being conducted for the WQD. Coordinate with CBP and USGS on activities related to the monitoring and streamflow gauges installed as part of the non-tidal network. Coordinate the activities related to the fish tissue study. Maintain the real-time monitoring network.	samples have been processed and are being analyzed. The project is expected to be completed in July 2018. 4. Rhithron Associates continues to enumerate the macroinvertebrate, phytoplanton and zooplankton samples. 5. The FY 2018 JFA between DDOE and USGS to expand the non-tidal monitoring parameters to include trace metals, mercury, and *E. coli* has been executed. 6. The real-time monitors were redeployed on March 2018. Readings are being taken every 15 minutes.

Goal 2: Clean and Safe Water			
Objective 2: Protect Water Quality			
Sub-objective 2.2.1: Improve Water Quality on a Watershed Basis			
Work Plan Component/Program: Water Quality Assessment Workyears:	EPA Contact: Bill Richardson/Kelly Somers	District Contact: N. Shulterbrandt	Program Result Code (PRC): 202B06
Program Description: WQD staff evaluate data collected from ambient monitoring network and assess waterbodies for use attainment. Evaluations and supporting data are entered into a database.			

Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs for FY- 2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
Number of District Watersheds where water quality standards are met or improved in at least 80% of the assessed water segments; all assessed water segments maintain their quality; and at least 20% of assessed water segments show improvement above conditions in 2002.	**WQ-7:** Number of States and Territories that provide electronic information using the Assessment Database version 2 or later (or compatible system) and geo-reference the information to facilitate the integrated reporting of assessment data. (cumulative)	Output: Submit annual data and assessment decisions by April 1, 2018. Submit ADB file output or the ATTAINS system (if it is live) by April 1, 2018. **Activities:** Assess waterbodies based on data collected and water quality standards. Utilize EPA's updated ATTAINS system to submit draft and final 2018 Integrated Report submission to EPA including but not limited to: narrative report, IR category tables, assessment data and GIS files.	1. The submission of the draft 2018 IR has been delayed, due to issues with the new ATTAINS system.

GOAL 2: Ground water that supports beneficial uses			
OBJECTIVE: Protect ground water as a natural resource by monitoring and maintaining aquifers (including recharge areas) and reducing contaminant loads			
Work Plan Component /Program: Ground Water Protection Workyears:	EPA Contact: Cathy Magliocchetti	District Contact: D. Douglas	Program Result Code (PRC): 202B06
Program Description: The Ground Water Protection Program (GWPP) seeks to protect ground water for beneficial uses including surface water recharge, drinking water in other jurisdictions, and potential use as a raw drinking water resource. Currently, the GWPP is focused on the Anacostia River Watershed. With great interest in finding solutions to address the contamination in the Anacostia River, it is critical to characterize the ground water flux to the river and provide regulatory oversight to prevent off-site contaminant migration especially from shoreline facilities. The GWPP also coordinates with other federal and local agencies and the public to ensure that issues pertaining to the program are considered, especially during policy and decision making. Updating and passing new regulations also are expected to help to develop a robust framework for ground water protection.			

Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs for FY- 2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
Protect human health and the environment by reducing exposure to contaminants in ambient water.	Identify and address at a District of Columbia level important threats to ground water quantity and quality	**Activities:** Establish a Joint Funding Agreement with the U.S. Geological Survey (USGS) to continue to maintain and collect data from the ground water monitoring network and tide gauge. The data will be published in the USGS Annual Water Data Report. In addition, USGS will review and evaluate existing groundwater data for the District especially in the Anacostia River watershed to possibly identify typical or natural concentrations of inorganic constituents by aquifer. Base maps and findings from work conducted earlier for the paleochannel investigation will be published. Summary reports will be submitted at the end of FY 2018 by USGS. Funding also will be sought from USGS and the Section 604(b) Water Quality Planning Management Grant. The project will be expanded or scaled back depending on available funding. Program Support (Items 1 – 7): 1. Conduct site visits; review and prepare comments on various environmental assessment documents; and provide overall regulatory oversight at contaminated sites where ground water is or may be impacted, where contaminated or non-contaminated ground water is discharging to surface water bodies or where contaminated ground water is or may be impacting sediments. Continue development and use of groundwater flow models to evaluate effects on groundwater flux and quality where necessary. 2. Review for approval workplans for well maintenance and provide technical assistance for well permit applications.	A draft JFA has been prepared for signature using 604b funds. When funding for this grant is received, the JFA will either be modified or a new JFA will be signed for this work. 2. Ongoing. Provided regulatory oversight at various sites including Joint Base Anacostia-Bolling, the Spring Valley Formerly Used Defense Site, Washington Gas, Capitol Crossing project, South Capitol Street Bridge, the Ballpark Stadium, and several District Department of General Services properties. EISFs

		3. Finalize well guidance document, if necessary, and update ground water quality standards. 4. Coordinate with other programs within the DOEE for ground water-related issues. 5. Participate in local and regional groups that promote the protection of ground water. 6. Perform public outreach and respond to public inquiries related to ground water. 7. Conduct grant administration.	and EAs also were reviewed for groundwater issues. 3. To enhance protection of groundwater resources, various modeling activities were conducted including: 4. Completion of a plan to address groundwater modeling in the District. 5. The Anacostia Watershed Groundwater Model made by the USGS was adapted to run on Groundwater Vistas and also to run in the USGS software MODELMUSE. The results of this regional model were considered to define the boundary conditions of the new DC Groundwater Model. • The preliminary version of a detailed 3D flow and transport model for the Bolling Air Force Base, was used for understanding the degree of complexity of the groundwater system, parameter collection of hydrogeologic units, and understanding the interaction of groundwater with the

			Potomac River. • On-going development of a MODFLOW 3-D groundwater flow and transport model for the Tidal Anacostia River in DC, based on the adaptation of the existing Anacostia Watershed Groundwater Model made by the USGS, and the understanding of the groundwater system. The model layers and parameters have been refined using DOEE's large collection of existing boring logs and all available hydrogeological information for the District. 6. Ongoing. DOEE approved permits in both private and public spaces. 7. Work is continuing to finalize the Well Guidance document. Discussions are ongoing to update the ground water quality standards. 8. When necessary, the GWPP coordinates with the programs responsible for

			NPDES permits and US Army Corps of Engineers Nationwide Permits for construction in wetlands and navigable waters. 9. On-going coordination also occurs with other Divisions for well permits requested at contaminated groundwater sites and Planned Unit Developments. The Program provided comments on technical guidelines for conducting groundwater characterizations at contaminated sites where construction dewatering is expected and reviewed workplans and reports for several projects. Comments were submitted on the Anacostia River Sediment Project Preliminary Remediation Goals and the Anacostia River Sediments remedial investigation report. The GWPP also assisted the Energy Program with a proposal to map the District's geothermal potential. 10. On-going through interaction with other states, the International Ground Source Heat Pump Association,

			other states, and other District agencies with projects involving groundwater and environmental groups. 11. DOEE coordinated with various entities regarding well permitting, water use, water quality monitoring and contaminant investigations. 12. Ongoing.

Goal 2: Clean and Safe Water			
Objective: 4.3. Protect Wetlands			
Sub-objective 2.2.1: Improve Water Quality on a Watershed Basis			
Work Plan Component/Program: Wetland Protection Workyears:	EPA Contact: Mike Mansolino/Kelly Somers	District Contact: B. Van Wye	Program Result Code (PRC): 202B06
Program Description: WQD staff review section 404 permits drafted by the U.S. Army Corps of Engineers (COE) –Baltimore District and issue certifications when appropriate. The program objective is to make sure activities in the District's waters are conducted in a manner that does not violate D.C. water quality standards and to protect wetlands.			

Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs for FY- 2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
No net loss of wetlands	**WQ-11** Ensure no net loss of wetlands.	Issue water quality certifications for Section 404 program. Draft updates to the 1997 Wetland Conservation Plan and a preliminary geodatabase to house the District's Wetland Registry. **Activities:** Review project applications, delineation reports, and jurisdictional determinations. Develop certification conditions. Hold conference calls with COE and applicants to discuss comments on permits and certifications. Prepare reports assessing current wetland related activities. Build the WQD's capacity related to wetland monitoring, regulations, and standards. Review and certify draft permits issued by the COE.	1. RRD has created a template structure for water quality certifications and a thorough list of conditions to assign to on a case by case basis. 2. RRD and COE have worked in conjunction on several projects. 3. RRD is working closely with the District's Floodplain Manager, DOEE's Watershed Protection Division, DCRA, and DOEE's Well Program to provide thorough and multi-disciplinary reviews of wetland related projects. 4. The Wetland Conservation Plan Update and Registry update will provide baseline and wetland functional assessment data for known wetlands in the District.

Objective 2: Protect Water Quality			
Sub-objective 2.2.1: Improve Water Quality on a Watershed Basis			
Work Plan Component/Program: Program Management Workyears:	EPA Contact: Kelly Somers	District Contact: J. Seltzer	Program Result Code (PRC): 202B06
Program Description: Water Quality Division management is responsible for developing the section 106 grant related work plan, budget and grant applications as well as oversight of the implementation of the grant work plan, policies, and regulations related to water quality.			

Environmental Outcomes (result, effect or consequence-quantitative)	Measures	Outputs for FY- 2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
Reduce pollution to surface waters.	**SP-10** Number of waterbodies identified in 2002 as not attaining water quality standards where standards are now fully attained. **SP-11** Remove the specific causes of waterbody impairment identified by states in 2002. **SP-12** Improve water quality conditions in impaired watersheds nationwide using the watershed approach. **WQ-11** Establish and maintain an effective program. **WQ-SP13.N11:** Ensure that the condition of the Nation's streams does not degrade.	**Output**: Submit semi-annual grant reports providing updates on activities relating to attainment of water quality standards, removal of causes of waterbody impairment and improvement in water quality conditions. Submit by April 30, 2018. Submit annual/final grant reports detailing progress made on activities relating to attainment of water quality standards, removal of causes of waterbody impairment and improvement in water quality conditions, including any data, studies, assessments, and project reports. Submit by October 31, 2018. **Activity:** Manage and provide oversight for the water quality programs to ensure that an effective program is maintained. Revise and submit an updated Continuous Planning Process. Ensure that all the programmatic and administrative requirements of the grant are met. Staff participation in local, regional, or national policy meetings and training opportunities. Participate in joint evaluation of grant activities with US EPA Region III.	- Oversight of the water quality management program is ongoing. - The Continuous Planning Process (CPP) document is being updated. - DOEE is working towards meeting the programmatic and administrative requirements of the grant. - Staff participated in the following meetings/training: EPA Region III Annual Source Water Protection

			Meeting, Potomac River Source Water Protection Meetings; ACWA Mid-Year Meeting; various Chesapeake Bay Program meetings; regional Anacostia River restoration meetings; Trash TMDL meetings; EPA Region III NPDES meeting.

Goal 2: Safe and Clean Water – Ensure drinking water is safe. Restore and maintain oceans, watersheds, and their aquatic ecosystems to protect human health, support economic and recreational activities, and provide healthy habitat for fish, plants, and wildlife.			
Objective 2.2: Objective 2: Protect Water Quality – Protect the quality of rivers, lakes and streams on a watershed basis and protect coastal and ocean waters.			
Subobjective 2.2.1: Improve Water Quality on a Watershed Basis - Use pollution prevention and restoration approaches to protect and restore the quality of rivers, lakes, and streams on a watershed basis.			
Work Plan Component/Program: Enforcement Workyears:	EPA Contact (s): Ingrid Hopkins/Kelly Somers	State Contacts: C. Burrell	Program Result Code (PRC): 202B06
Program Description: Initiate actions outlined in the Clean Water Act (CWA) Action Plan aimed to focus DOEE's NPDES planning and resources on the most significant sources of water quality impairment. The Office of Enforcement and Compliance Assurance and the Office of Water requested Region 3 to work with DOEE to identify water quality priorities at the national, regional and state level. Strengthening US EPA and State Performance work plans focus on individual NPDES program areas to ensure a coordinated and integrated planning process across the permitting and enforcement programs.			

Environmental Outcomes	Measures	Outputs for FY- 2018 (Commitments- activity or work product-qualitative or quantitative)	Status/Comment
Reduce and eliminate pollution to surface waters		**OUTPUTS:** Semi-annual reports submitted through the Section 106 grant. **ACTIVITIES:** State implementation of the priorities, initiatives and strategies proposed during the early engagement for the FY 2018-2019 National Water Program Guidance and the FY2018 – 2019 OECA National Program Manager Guidance.	1. The District of Columbia FY 2018 Proposed Compliance Monitoring Strategy were submitted to EPA in October 2017. 2. CEIs are conducted in accordance with the Compliance Monitoring Strategy. 3. The Semi-annual Compliance Monitoring Strategy report is

			submitted to EPA.

WELL REGULATION GUIDANCE

FOR USE IN CONJUNCTION WITH

THE DISTRICT OF COLUMBIA MUNICIPAL REGULATIONS
CHAPTER 18 WELL CONSTRUCTION, MAINTENANCE,
AND ABANDONMENT STANDARDS

AS PROMULGATED ON OCTOBER 28, 2016

Prepared for:

District of Columbia Government
Department of Energy and Environment
1200 First Street NE, 5th Floor
Washington, DC 20002

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Chapter 1 Introduction

1.1 Introduction

Wells in the District of Columbia (the District) are defined in the well regulations as any test hole, shaft, or soil excavation created by any means including, but not limited to, drilling, coring, boring, washing, driving, digging, or jetting; for purposes including, but not limited to, locating, testing, diverting, artificially recharging, or withdrawing fluids, or for the purpose of underground injection.

By the nature of their design, wells provide a direct pathway for solids, liquids, and vapors to migrate between the ground surface and the subsurface. Permits ensure that wells are constructed in a manner that protects property, the environment, human health and safety, and the District's water resources.

District of Columbia's groundwater is a critical resource that provides environmental benefits and contributes to the well-being of the citizens of the District and, in specific cases, a source of water.

Adequate protection of the District's groundwater requires all the wells, borings and instrumentation installed to meet their objectives in a manner that prevents negative effects in the waters of the District.

Preserving the quality of groundwater is important for its current use, as much as for its potential use as awater reserve. Additionally, groundwater is critical to the protection of the District's surface streams, since it provides the sustaining baseflow to the District's surface waters.

Recognizing these issues, the District promulgated the Well Construction, Maintenance, and Abandonment Standards (well regulations). These regulations (Chapter 18 of Title 21 of the District of Columbia Municipal Regulations) describe the process to apply for a well construction permit in the District and detail the standards and procedures of proper well construction, including the specific components of a well such as the well casing, the well outer casing, the well screen, the filter pack, and grout. The rules also outline the proper procedures for handling derived waste and drilling fluid in addition to proper well abandonment.

This Well Regulation Guidance Document (The Guidance Document) provides technical guidance on well regulations.

Purpose and Scope

The purpose of this Well Regulation Guidance Document is to provide supporting guidance to Well Permit Applicants regarding the requirements and associated permit processes of the Well Construction, Maintenance, and Abandonment Standards (well regulations) which were promulgated on October 28, 2016. Well Permit Applicants are considered to be individuals and businesses that own, construct, maintain, or abandon wells in the District and those who seek to engage in these activities. The Guidance Document includes the following:

1.1.1.1 An overview of the well construction permit application process and the well registration process, including the responsible District agencies or divisions for private-space or public-space well permits, specific steps to complete the required permit forms, and other supplemental guidance such as figures, schematics, and spreadsheets;

- Detailed procedures and specifications for well construction, use, maintenance, and abandonment;
- Detailed requirements regarding contaminated sites, procedures for decontamination, and the management of derived waste; and
- Incorporated information (as applicable) from public comment. The public comment period was _____, 2017 to _____, 2018.

Document Format

The general format of the Well Guidance Document consists of a brief regulatory overview, a description of the well permit process, and separate sections dedicated to the specifics of the construction, use, maintenance, and abandonment requirements for various types of wells. Where applicable, wells of similar type are grouped into individual sections. Forms, work plans, and other supplemental guidance such as figures, schematics, and spreadsheets, have also been consolidated.

Document Use and Point of Contact

It is the intent that the Well Guidance Document will be used in conjunction with the District's Well Construction, Maintenance, and Abandonment Standards (21 DCMR 18), which are the enforceable regulations (Well Regulations). The public can download the Well Regulations in the following link: http://www.dcregs.dc.gov/Gateway/NoticeHome.aspx?NoticeID=6245168.

The Regulatory Review Division is the point of contact for any issue or question related to permits, construction, maintenance and abandonment of wells in the District:

Phone: (202) 535-2600, Email: well.permits@dc.govebsite, Website: doee.dc.gov/wells

Conflicts with the Applicable Law

If any conflicts arise between the Well Guidance Document and any provision of applicable law, including a public law, statute, or regulation (including the District's Well Construction, Maintenance, and Abandonment Standards), the provision of the law shall control.

It is the responsibility of the design professional (engineer, geologist, or scientist) to review, verify, and select the appropriate best management practices and materials for a specific well and submit to DOEE, as required, all reports, design computations, worksheets, geotechnical studies, hydrogeological studies, environmental studies, etc. Each such required submittal will bear the seal and/or signature of the professional who is responsible for that portion of the project.

Chapter 2 Application Process

2.1 Introduction

There are 3 well permitting processes that apply to wells in Per the District:

During construction permitting, projects apply for permission to install a well. For wells being newly constructed, well registration is accomplished during the construction permitting process. As of 2021, existing wells in the District will be required to go through DOEE's well registration process. Last, to abandon a well, a project must obtain DOEE approval of a well abandonment plan. In some cases, a well abandonment plan can be submitted as part of the application to construct a well. More explanation on each of these processes is provided below.

In the District of Columbia's Water Pollution Control Act DC Law §8-103.01(26A) of the Water Pollution Control Act, a "well" is defined as, "any test hole, shaft, or soil excavation created by any means including, but not limited to, drilling, coring, boring, washing, driving, digging, or jetting, for purposes including, but not limited to, locating, testing, diverting, artificially recharging, or withdrawing fluids, or for the purpose of underground injection." The Well regulations were developed to ensure that construction, maintenance, and abandonment-related activities for a well in the District are undertaken in a manner that protects public health and safety and the environment.

The Well regulations contained detailed procedures and specifications for well-related activities. This guidance document shall provide supporting guidance regarding the detailed procedures and specifications for well construction, maintenance, and abandonment to assist the well permit applicant with achieving regulatory compliance.

2.2 Governing Regulations for Well Permit Applications

Applicants for well construction, maintenance, and abandonment permits are responsible for complying with the District of Columbia Municipal Regulations, Department of Energy and Environment, Title 21 Water and Sanitation, Chapter 18 Well Construction, Maintenance, and Abandonment Standards, 21 DCMR §§ 1800-1899, (herein referred to as the "Well Regulations").

The provisions of Title 21, Chapter 18 shall be applicable to the construction, maintenance, and abandonment of wells in the District of Columbia, pursuant to the Water Pollution Control Act of 1984, effective March 16, 1985 (D.C. Law 5-188; D.C. Official Code §§ 8-103.01 et seq.).

2.2.1 Private-Space Well Permitting (DCRA)

The District's Department of Consumer and Regulatory Affairs (DCRA) maintains the authority to issue permits for wells located on private-space property.

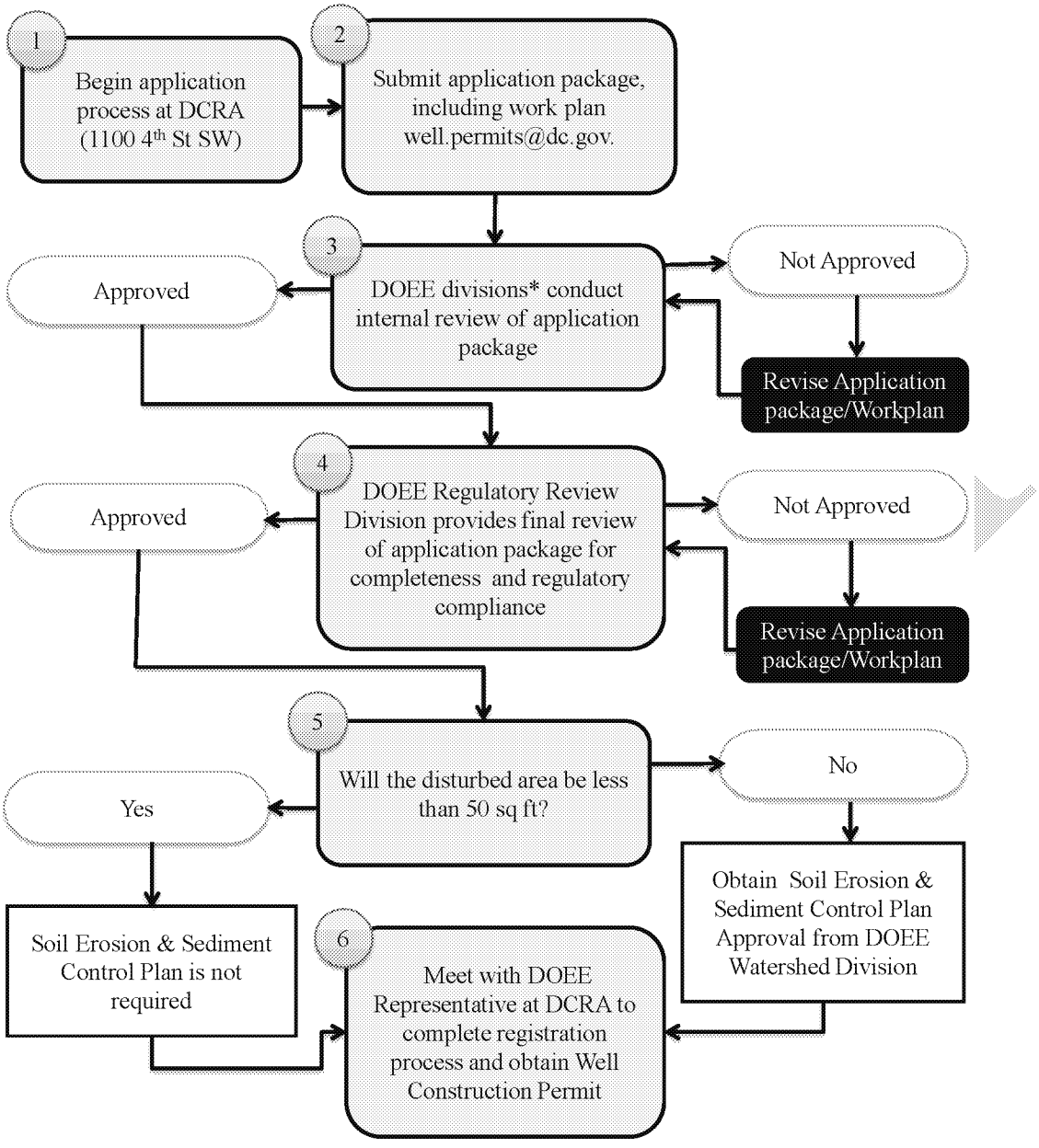
DOEE is responsible for reviewing the technical aspects of well and soil boring permit applications located on private-space property.

DOEE is also responsible for coordinating with other divisions or District agencies or divisions that may be required to review a permit application for wells located on private-space property based on site specific conditions. These other divisions or District agencies or divisions may add conditions or require changes to the well permit application based upon their review. The other divisions or District agencies or divisions may include, but not be limited to:

- DOEE Watershed, Air Quality, and Hazardous Waste divisions.
- DOEE Toxic Substances Division through the Underground Storage Tank (UST) and Leaking Underground Storage Tank (LUST) Programs.
- DOEE Land Remediation and Development Division through the Remediation and Site Response (RSR) Program.
- DCRA Structural and Fine Arts/Historic divisions, etc.

Overview of Well Construction Permit Application/Registration and Work Plan Process

Provided below is a written overview of the DCRA private-space permitting process for wells located on private-space property. This written description is also supplemented by flow-charts that present the DCRA permitting process in an alternate format (see Figure 1 and Figure 2 Refer to Flow Charts of DCRA Well Permitting Process Flow Chart for Private-Space Property and Flow Chart of Well Permitting Process for Regulatory Reviews of Other agencies and divisions).



*Based on the DOEE Environmental Questionnaire, the following divisions review for approval the proposed application package: Underground Storage Tank Division, Water Quality Division, Air Quality Division, Hazardous Waste Division. Each Division may add conditions or require changes.

Figure 1 Flow chart of DCRA well permitting process for private space property.

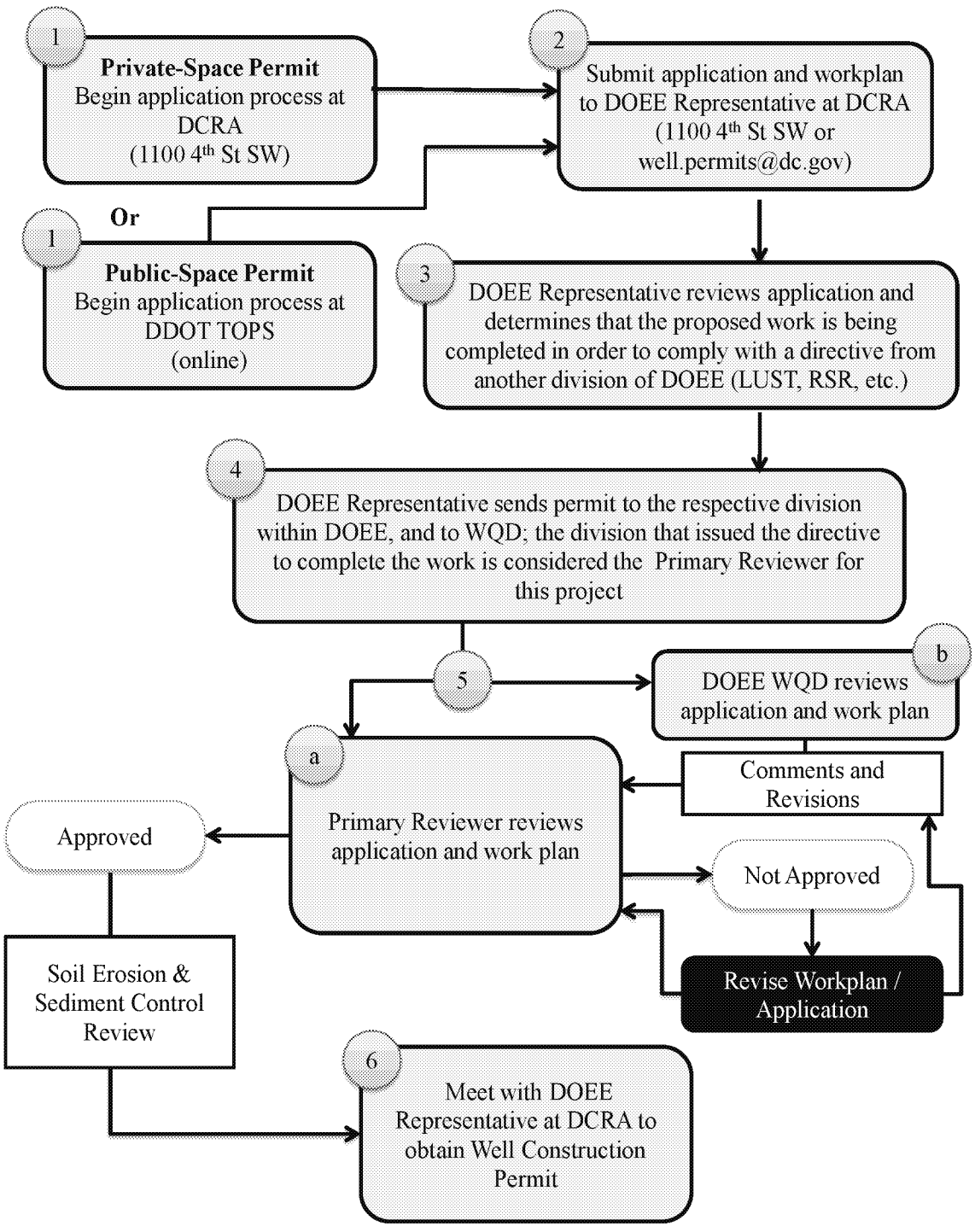


Figure 2 Flow chart of well permitting process for reviews of other divisions and agencies.

- The Well Owner or Well Permit applicant has to prepare and submit a permit application package. The application package consists of a well construction permit application to

DCRA, which also requires the submission of a well construction work plan (work plan) and any other information as required by DOEE.

- All well construction permit applications/registrations, well construction completion reports, and well abandonment work plans/reports and other well-related information should be submitted electronically to well.permits@dc.gov.
- Upon receipt and processing of the application package, DOEE will instruct the Well Owner or the Well Permit applicant to proceed with the permitting process by visiting DOEE staff located at DCRA offices.
- DOEE conducts an internal regulatory review of the well application package to determine if the submission is administratively and technically complete. The internal review also determines if the application package requires reviews from other DOEE divisions or other District agencies.
  - If the application package is determined to be administratively and technically complete and requires no further regulatory reviews by other DOEE divisions or District agencies, the review process is complete. The application package will then proceed to the well registration process.
  - If the application package is determined not to not be administratively and technically complete, DOEE will notify the Well Owner or Well Permit applicant of the deficiencies. The Well Owner or Well Permit applicant will be required to revise and resubmit the application package. Upon receipt of the revised application package, DOEE will perform another regulatory review. This process will continue until the application package is determined to be administratively and technically complete. Upon meeting all applicable requirements, the application package will then proceed to the well registration process.
  - If the application package requires additional regulatory reviews from other DOEE divisions or other District agencies, the application package will be distributed by DOEE.
    - If the application package is determined to be administratively and technically complete, the application package will be returned to DOEE to complete the review process. The application package will then proceed to the well registration process.
    - If the application package is determined not to not be administratively and technically complete, comments will be provided to DOEE. DOEE will notify the Well Owner or Well Permit applicant of the deficiencies. The Well Owner or Well Permit applicant will be required to revise and resubmit the application package. Upon receipt of the revised application package, DOEE, DOEE divisions, and other District agencies (as applicable) will perform another regulatory review. This process will continue until the application package is determined to be administratively and technically complete. Upon meeting all applicable requirements, the application package will then proceed to the well registration process.
- Upon notice of the application package being administratively and technically complete from DOEE, the Well Owner or Well Permit applicant will schedule a meeting with DOEE to complete the well registration process and obtain a well construction permit.

- Department reviews shall be conducted as referenced in Section 3.1 of this Well guidance document and per well Regulation §1804.

The well owner is responsible for reviewing well regulation §1803 and this guidance document so as to prepare permit applications and work plans in accordance with DOEE requirements.

The work plan requirements are specified in well regulation §1803, however, the applicant is responsible for developing the specific content in a clear and concise format. It is recommended that the order of the work plan follows that of well regulation §1803.

Well Construction Permit Application and Work Plan Procedures

In order to construct a well in the District, a person needs a DOEE approved work plan and a DOEE approved well construction permit that is issued by DCRA. Exceptions to this are listed in section 1802 of the well regulations.

A well owner may request a special compliance standard or the modification of a requirement from the well regulations.

Before requesting a special compliance standard or modification of the well regulations, alternative products, methods, or approaches that would result in compliance with the regulations should be considered. The well is intended to provide substantive measures to ensure that groundwater is protected and preserved for its beneficial uses. Where the well fails to anticipate conditions that could result in less protective measures than intended, DOEE welcomes input from the regulated community with information regarding how improvements can be made. It is with this perspective in mind that a well owner may request a special compliance standard or modification of a requirement of the Well Regulations. Therefore, a special compliance standard is expected to be at least as protective of groundwater and other natural resources as the existing standards.

Preclusions on construction of a well generally are associated with siting restrictions and well construction materials. The siting restrictions shall apply as specified in the well unless there are exceptional circumstances, such as a monitoring well being placed in a groundwater-fed, constructed remedial wetland to necessarily evaluate groundwater levels. In its efforts to protect natural resources, DOEE will evaluate well construction materials for their potential to add pollutants to the environment. As an example, although petroleum is a natural product and will naturally attenuate over time, it is listed as a non-hazardous substance by the EPA. , and will naturally attenuate over time even small concentrations are not acceptable in a drilling fluid. Similarly, good well design and physical methods are preferred and are necessary first steps prior to utilizing chemical treatment for well maintenance. Even if chemicals are approved, the type and amount applied must be carefully determined to present minimal impact to the environment. DOEE's evaluation of well construction materials will include an examination of the Safety Data Sheet for the chemical composition of the product, additives recommended by the manufacturer to make the product more suitable for its intended purpose, ecological impacts, etc. If the chemical composition is not available, the product cannot be approved for use.

As many new products and methods continue to become available on the market, DOEE recommends that these products and methods be carefully evaluated for their potential to have adverse human health or environmental impact before presenting them in a well construction permit application. This process may prevent delays that could be avoided.

The permit modification request shall include the proposed changes marked up on the previously-approved work plan and DCRA permit application, reasons for the changes, and supporting details. DOEE also may require a field inspection or other information to process the request. If a permit modification is approved and additional fees apply, then the fees shall be paid prior to issuance of the permit modification by DCRA.

The written request for a permit modification before well construction shall follow the same process used for a permit modification request submitted during well construction.

Department Review of Well Construction Permit Applications and Work Plans

DOEE shall review each well construction permit application submitted to DOEE though DC Department of Consumer and Regulatory Affairs (DCRA) and each well construction work plan to ensure that it meets the standards and requirements per Well Regulation §1804.

Department reviews shall be conducted as referenced in Section 3.1 of this Well Guidance document and per Well Regulation §1804.

Registration Process for Private and Public Space Well Permit Applications

Well owners or Well permit applicants shall have all the necessary permits and permissions before disturbing the ground or installing a well in the District. Provided below is the general registration process for well permit applications on for both private and public space.

- Complete and submit the DOEE Well Registration Form as part of the well construction permit application.
- The well permit application will be assigned to a reviewer who will calculate the registration fee amount and contact you.
- Once DOEE approves the application package, contact the DOEE well permit representative at DCRA via email at well.permits@dc.gov to schedule an appointment to complete the well permit application/registration process.
- Pay the registration fee at the DCRA Cashier's Office Before meeting with the DOEE well permit representative at DCRA to obtain signatures for permit issuance, pay the registration fee at the DCRA Cashier's Office. . Please be sure to bring your paid receipt to the appointment.
- A well ID tag may be distributed once the fees are paid and the registration process is completed. Note that the well ID tag is the property of the District of Columbia. It must be properly attached to the well and returned to DOEE when the well is abandoned.

Please note that the well construction permit application/registration process for both private space (DCRA) and public space will take place at DCRA in DOEE's Office Suite (3027) on the 3rd floor.

2.3 Public-Space Well Permitting

The District Department of Transportation (DDOT) maintains the authority to issue permits for wells located in public space. DOEE is responsible for reviewing the technical aspects of well or soil boring permit applications for wells located in public space, which also requires approval through DCRA.

DOEE also coordinates with the other District government agencies that may be required to review the permit application based on site-specific conditions. These District agencies may require changes to the permit application or add permit conditions or require changes to the well permit application based upon their review. The following DOEE divisions and District government agencies typically have a role to review well permit applications:

- DOEE divisions: Watershed Protection, Air Quality, Hazardous Waste, Toxic Substances (Underground Storage Tank and Leaking Underground Storage Tank Programs), and Land Remediation and Development (Remediation and Site Response Program)
- DCRA Structural and Fine Arts/Historic divisions
- District Department of Transportation
- Washington Metropolitan Area Transit Authority

Overview of Well Construction Permit Application and Work Plan Process

Provided Below is a written description of the DDOT public-space wells permitting process for wells located on public-space property. This written description is also supplemented by flow-charts that present the DDOT permitting process in an alternate format (see Figure 2 and Figure 3). Refer to the following Flow Chart of DDOT Well Permitting Process Flow Chart for Public-Space Property (for well excavation permits) and the Flow Chart of Well Permitting Process for Regulatory Reviews of Other agencies & divisions (see section 1.3).

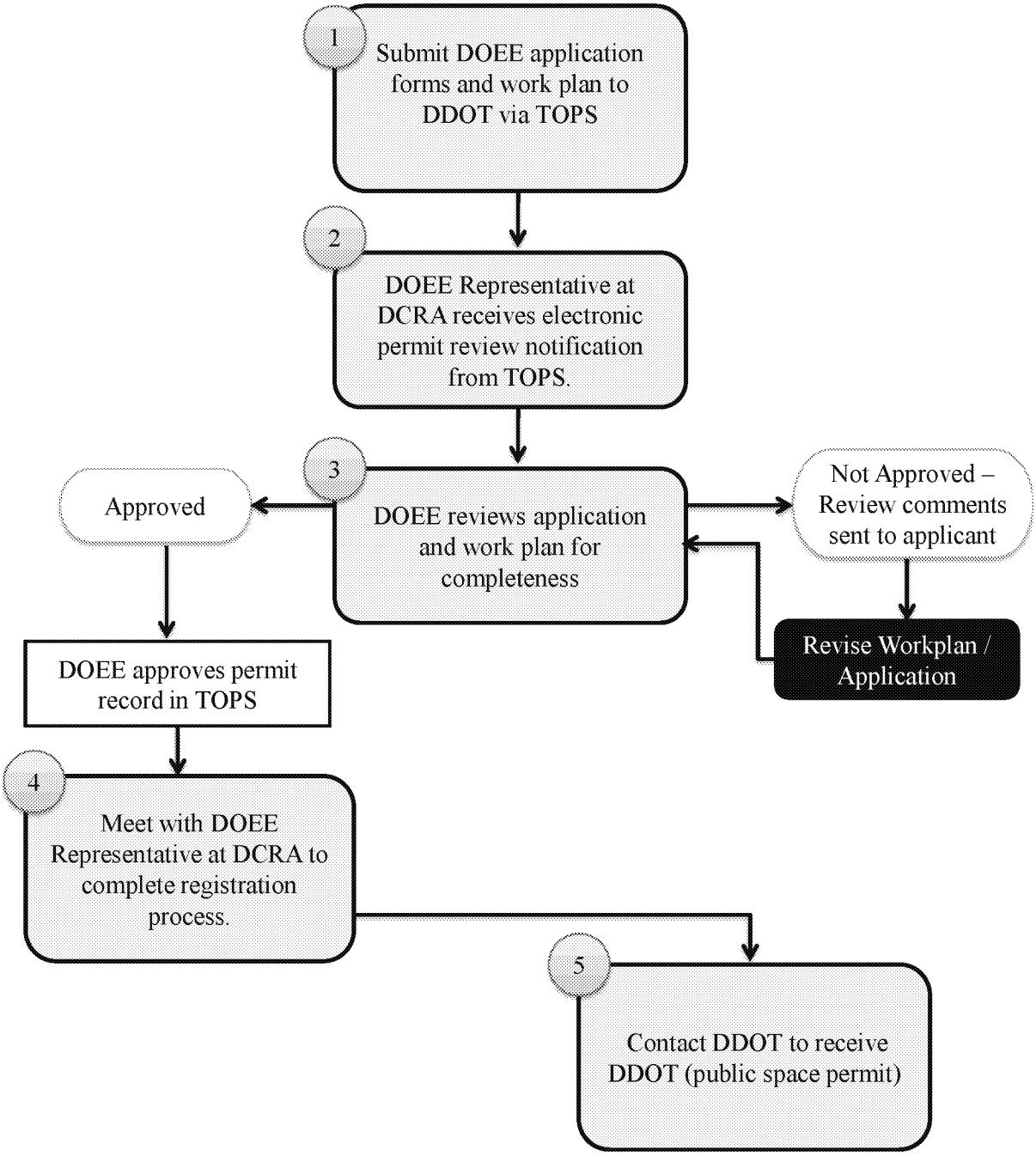


Figure 3 Flow chart of DDOT well permitting process (well excavation) for public space property.

In addition to DDOT's approval process, all public-space permits will require DCRA review to ensure by DCRA for well registration purposes. All public space permit approvals are contingent upon DCRA permit issuance and DOEE well registration processes being completed as it is shown in Figure 4.

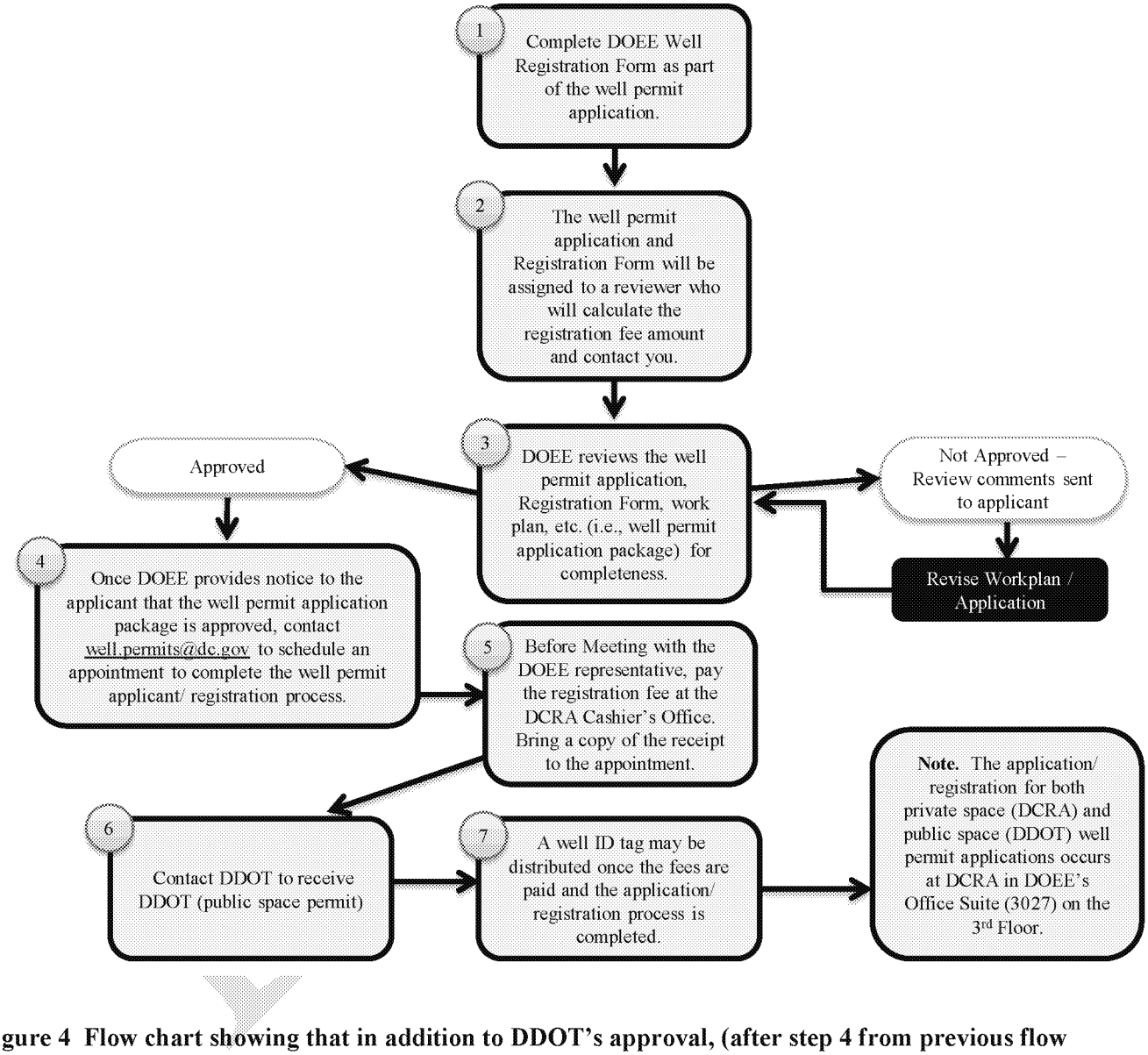


Figure 4 Flow chart showing that in addition to DDOT's approval, (after step 4 from previous flow chart) all wells require DCRA review to comply with the Well Regualtions.

- The Well Owner or Well permit applicant shall prepare and submit a web-based (electronic) permit application through DDOT's Transportation Online Permitting System (DTOPs). The web-based public-space permit application process for public-space permits was initiated by DDOT in on October 1, 2012, which requires the electronic submission of all required information and materials including a work plan. Required information and materials include

a web-based well permit application and a well construction work plan. The current webpage link is provided below:

https://tops.ddot.dc.gov/DDOTPERMITSYSTEM/DDOTPERMITONLINE/Landing.aspx

- If Well Owners or Well Permit Applicants require assistance with scanning documents, DDOT's Public Space Regulation Administration (PSRA) can provide assistance. These services by PSRA are only made available to residential property owners who are submitting material on their own behalf as well as small businesses owners who are not directly or indirectly associated with the property development and construction trades. PSRA is located at DDOT Permit Office – Permitting Center, 1100 4th Street SW, Washington, DC 20024.

- The applicant needs to register through DTOPS Prior to submitting a web-based permit application through DTOPS. , the Well Owner or Well Permit Applicant needs to register through DTOPS using the above referenced webpage link.
- Following registration, Well Owners or Well Permit applicants can log into DTOPS to complete the web-based well permit application.
- For Well Excavation Permits – upon receipt and processing of the web-based permit application by DDOT through DTOPS, DOEE will receive an electronic permit review notification.
  - DOEE will conduct an internal regulatory review of the well construction permit application to determine if the submission is administratively and technically complete.
  - If the well permit application is determined to be administratively and technically complete and requires no further regulatory reviews by DDOT, the review process is complete. DOEE will approve the permit record in DTOPS. DOEE will provide notification to the Well Owner or Well Permit Applicant to contact DDOT to receive the public-space permit.
  - If the well permit application is determined not to not be administratively and technically complete, DOEE will notify the Well Owner or Well Permit Applicant of the deficiencies. The Well Owner or Well Permit applicant will be required to revise and resubmit the well permit application. Upon receipt of the revised well permit application, DOEE will perform another regulatory review. This process will continue until the well permit application is determined to be administratively and technically complete. Upon meeting all applicable requirements, DOEE will approve the permit record in DTOPS. DOEE will provide notification to the Well Owner or Well Permit Applicant to contact DDOT to receive the public-space permit.
- For all other Well Permit Applications that require review by other District agencies, upon receipt and processing of the web-based permit application through DTOPS, DOEE will receive an electronic permit review notification.
  - DDOT will provide notification to the Well Owner or Well Permit Applicant that the permitting review process will continue with the DOEE well permit representative at the DCRA offices.
  - The Well Owner or Well Permit Applicant shall prepare and submit a well permit application and work plan to the DOEE well permit representative located at DCRA,

which also requires the submission of a well construction work plan. The submission process occurs at the DCRA office of DCRA at 1100 4th Street SW Washington, DC 20024. Alternatively, the submission process can occur via e-mail at well.permits@dc.gov.

- DOEE will conduct an internal regulatory review of the well permit application to determine that the proposed work is being completed in order to comply with a required directive from another DOEE division or other District agency.
    - DOEE will distribute the well permit application and well construction work plan to the respective DOEE division or other District agency (under the authority of DCRA refer to Section 1.3 of this Well Guidance Document, who will be designated as the primary reviewer.
    - If the primary Reviewer determines the well permit application and well construction work plan are administratively and technically complete, and requires no further regulatory reviews, – the review process is complete. The well permit application will then proceed to the well registration process, as described in Section 1.3.
    - If the primary Reviewer determines the well permit application and well construction work plan are not administratively and technically complete, DOEE will notify the Well Owner or Well Permit Applicant of the deficiencies. The Well Owner or Well Permit Applicant will be required to revise and resubmit the application package. Upon receipt of the revised application package, DOEE and the respective DOEE divisions or other District agencies will perform another regulatory review. This process will continue until the well permit application and well construction work plan are determined to be administratively and technically complete. Upon meeting all applicable requirements, the application package will then proceed to the well registration process.
- Upon notice of the well permit being administratively and technically complete from the Primary Reviewer, and requires no further regulatory reviews by DDOT, DOEE, other DOEE divisions or District agencies – the review process is complete.
- When the primary reviewer deems the application package complete, DOEE will provide notification to the Well Owner or Well Permit applicant to visit DCRA to complete the well registration process and obtain the well construction permit. DOEE will not approve the permit application in DTOPS until the DCRA permit is received and the well registration process is completed.
- Department reviews shall be conducted as referenced in Section 3.1 of this Well Guidance document and per Well Regulation §1804.

The well owner is responsible for reviewing DDOT requirements, well regulation §1803, and this guidance document so as to prepare permit applications and work plans in accordance with DOEE requirements.

The work plan requirements are specified in well regulation §1803, however, the applicant is responsible for developing the specific content in a clear and concise format. It is recommended that the order of the work plan follows that of well regulation §1803.

Well Construction Permit Application and Work Plan Procedures

In order to construct a well in the District, a person needs a DOEE approved work plan and a DOEE approved well construction permit that is issued by DCRA. Exceptions to this are listed in section 1802 of the well regulations.

Except as provided in §1802, no person shall construct a well in the District without a well construction work plan conforming to the requirements of §1803.3 approved by DOEE, and a well construction permit approved by DOEE and issued by DOEE of Consumer and Regulatory Affairs (DCRA).

The Well Owner shall apply to the DCRA for a well construction permit, which shall be issued by DCRA subject to the requirements of this Section.

2.4 Well Permitting Forms, Work Plans, and Supplemental Guidance Documents

The purpose of this section is to provide general purpose and use guidance for the various forms, work plans, and other supplemental guidance Documents (spreadsheets) that have been incorporated into this Well Guidance document.

Forms

Well Construction Permit Application/Registration Form – to be used for all well-types except closed-loop ground source heat pump wells, ground freeze wells, water supply wells, jet grouting/secant piling/other soil stabilizing wells and dewatering wells.

- Geothermal Well Construction Permit Application/Registration Form – to be used for closed-loop ground source heat pump wells.
- Dewatering Well Construction Permit Application/Registration Form – to be used for dewatering wells.
- Ground Freeze Well Construction Permit Application/Registration Form – to be used for ground freeze wells.
- Jet Grouting/Secant Piling/Other Soil Stabilizing Well Construction Permit Application/Registration Form – to be used for various other types of wells not previously referenced.
- Well Construction Completion Report – to be used for all well-types except closed-loop ground source heat pump wells and ground freeze wells.
- Geothermal Well Construction Completion Report – to be used for closed-loop ground source heat pump wells.
- Ground Freeze Well Construction Completion Report – to be used for ground freeze wells.
- Well Development Log Form – to be used for all well-types for well development activities.
- Well Pumping Test Application Form – to be used for all well-types for well pumping test activities.
- Well Additional Geographic Data Form – to be used for all well-types for multiple wells at the same site location.

- Well Abandonment Application Form – to be used for all well-types for abandonment activities.
- Well Abandonment Report – to be used for all well-types abandonment activities.
- Well Registration/Completion Form – to be used for Unregistered Wells prior to March 31, 2017.
- Well Registration Renewal Form – to be used for all well-types for registration renewals.
- Well Change-In-Use Form – to be used for all well-types when applying for a change-in-use.
- Well Change-In-Ownership Form – to be used for all well-types when applying for a change-in-ownership.
- Well Construction Work Plan (to accompany the well construction permit application)
    - Well Construction Work Plan – required for all well-types. The work plan requirements are specified in well regulation §1803, however, the applicant is responsible for developing the specific content in a clear and concise format. It is recommended that the order of the work plan follows that of well regulation §1803.
    - Well Construction work plan – shall also include information regarding existing conditions at the proposed well location site regarding contamination, the management of derived solid and liquid waste, and decontamination procedures.
- Form Instructions – instructions have been prepared to assist well permit applicants with the completion of each form.

Spreadsheets (Refer to Appendix B)

- Multiple Well-Boring Data Collection Sheet – to be used for all well-types when applying for multiple wells or borings.

2.5 Well Construction – Completion Reporting

Per Well Regulation §1826, A completion report shall be provided to DOEE within sixty (60) calendar days of construction of a new well.

A well completion report shall not be required for a well currently under a Department regulatory action, or for a well that is exempt from the well construction permit requirement pursuant to §1802.

A well completion report submitted to DOEE shall include the details listed in §1826.3 of the well regulations.

Per well regulations §1809.5, if a soil boring is abandoned within 24 hours of the start of construction, a completion report is not required.

If Soil Borings, Geotechnical Borings, and Geotechnical Wells, do not meet these conditions, the construction standards of the Well Regulations are then applicable (§1809.6, and §1815 through §1826)and a completion report is required.

2.6 Well Registration, Renewals, and Change-in-Use or Ownership

2.6.1 Process for Unregistered Wells prior to the Promulgation of the Well Regulations

Registrations for unregistered or pre-existing wells constructed prior to March 31, 2017 will occur at the DCRA offices at 1100 4th Street SW Washington, DC 20024. Well owners are required to complete and submit a well registration form and provide all required information to DCRA. The Well Owner maintains responsibility to perform well registration renewals in accordance with the requirements and timelines per Well Regulation §1806.

All well construction permit applications/registrations, well construction completion reports, and well abandonment work plans/reports and other well-related information should be submitted electronically to well.permits@dc.gov. DOEE will issue a unique well registration number for each well included in an approved well construction permit application and well construction work plan or registered with DOEE registration form.

By March 31, 2021, a the owner of any well constructed prior to March 31, 2017, shall:

a. Submit a well completion report, if the well was permitted by DOEE (use form Well Construction Completion Form from Appendix A);

b. Submit a registration application, if the well was not permitted by DOEE; or

c. Abandon the well in accordance with the procedures in §§ 1830 and 1831 of the well regulations.

The well registration/completion form, including the information required by the Well Regulations is included in the Appendix A.

Additionally DOEE may require submission of additional information as part of the well registration such as the application (intended use of the well. , including the use of a recovery well, monitoring well, observation well, piezometer, industrial supply well, irrigation supply well, or domestic supply well).

2.6.2 Process for New Wells following Constructed after the Well Regulation Promulgation of the Well Regulations

DOEE will issue a unique well registration number for each well included in an approved well construction permit application and well construction work plan or registered with a DOEE registration form.

The registration of new private-space and public-space wells constructed following after March 31, 2017 will occur through the Well Construction permit Application and well Completion processes forms (for both private-space and public-space well permits) using DOEE approved forms (appendix A) as specified in the Well Regulations.

Well owners are required to complete and submit a well construction permit application/registration, construction work plan, well construction completion report, and all required information to well.permits@dc.gov.

All well construction permit applications/registrations, well construction completion reports, and well abandonment work plans/reports and other well-related information should be submitted electronically to well.permits@dc.gov.

Well registrations will occur at the offices of the Department of Consumer and Regulatory Afffairs (DCRA), by appointment only, at 1100 4th Street SW, Washington, DC 20024.

2.6.3 Registration Renewals

Renewals for well registrations will occur at the offices of DCRA at 1100 4th Street SW, Washington, DC 20024. Well owners are required to complete and submit a Well registration Renewal Form and provide all required information to DCRA. The well owner maintains responsibility to perform well registration renewals in accordance with the requirements and timelines per Well Regulation §1806.

All well construction permit applications/registrations, well construction completion reports, and well abandonment work plans/reports, and other well-related information should be submitted electronically to well.permits@dc.gov.

As per the Well Regulations, for all wells, with exemption of a well that has been constructed under a Department regulatory action, the owner shall have their registration renewed every two (2) years, and for the closed-loop ground source heat pump wells which is every five (5) years. Wells that have been constructed due to a Department regulatory action do not need to be registered.

2.6.4 Change of Well Use or Ownership

Per Well Regulation §1807, the transfer of well ownership shall be registered by the new owner by March 31st of the calendar year following the transfer and the authorized use shall not be changed.

For a change in the use of the well, additionally to the requirements from the well regulations (1807.3), a Change- in-Use includes the purpose for a well and how it is operated. In addition to the To support a change-in-Use use application, it is recommended that the Well Owner provide:

- boring logs;
- a site plan;
- DOEE Additional Well Geographic Data Form if more than one (1) well is to be changed per site;
- DOEE Well Schematic;
- DOEE Well Development Log, if applicable;
- the current condition of the well;
- any problem or issue with the well construction, use, or maintenance;
- reason(s) for the request;
- details of the proposed Change-in-Use;
- any changes that will be necessary to the well construction, or maintenance;

- any foreseeable problem or issue with the proposed Change-in-Use;
- any potential environment impacts;
- any conflicts with 21 DCMR 18 or other District or Federal laws and regulations as it is the case for Supply and Injection Wells which also are under regulatory control of the United States Environmental Protection Agency Region III;
- any permit, authorization, or determination issued by another regulatory agency relevant to the application;
- proposed schedule; and
- Any additional comments or relevant information.

DOEE may require additional information and may need to inspect the well and site conditions as part of the application review process.

Also, the well owner is responsible for compliance with all District of Columbia and federal laws and regulations that apply to the new well use. Specifically, change in use of a water supply well may be subject to the Safe Drinking Water Act. The EPA Region III Underground Injection Program also may need to review and approve any changes to use of an injection well. In addition, a well owner proposing to change a well's use to that of a water supply or injection well must have EPA Region III's approval. In such cases, after obtaining approval from both EPA and DOEE for a well change in use, the well owner is required to report to DOEE when the change in use begins.

2.6.5 Well Elevation and Horizontal Location Determination

The elevation of the reference point of a well can be determined in several ways:

- Surveying to a benchmark;
- Using the "DC Atlas Plus" layers and tools from the DC website: http://atlasplus.dcgis.dc.gov; and
- Using a global positioning system (GPS).

While surveying is the most accurate (± 0.1 ft), the latitude and longitude of the well can be established accurately using a handheld GPS. With this information, the well can be located on the "DC Atlas Plus" Air aerial Photographs and the elevation estimated using the 2 feet contour map and the spot elevations layers. However, the accuracy is only about ± one half of the contour interval. Thus, for a contour interval of 2 feet, the accuracy of the elevation estimate would be about ± 1 foot. In case the elevation of the wells is surveyed relative to an existing datum or reference point, the top of the well casing is the most reliable point for the elevation survey, given that the height of the well casing above ground surface, commonly called stick up, is measured. Ground surface is typically not an accurate basis for the elevation survey.

The horizontal location of the wells is also required. Although an accurate survey is preferable, most GPS methods are suitable for determining well location. The DC Atlas Plus can also be used to define the coordinates using the location tool from the tools menu.

2.6.6 Determination of the Structural Integrity of the Well

If the well was installed more than 10 years ago the well owner must get the well professionally inspected by a water well contractor to determine the condition of the well.

If the well was installed less than 10 years ago, the structural integrity will be supported by all records related to the well including:

a. Well completion report and/or log which should include information such as water well depth, date drilled, construction (including casing specifications, grouting and screen depending on the type of well);

b. and from Pumping well information like : water well yield or flow rate in gallons per minute (gpm) and water quality test reports;

c. Past inspection reports;

d. Invoices from work done by water well contractors (including if applicable: maintenance, equipment, and pump replacement); and

e. Water treatment equipment warranties, invoices, and manuals.

2.7 Exemptions for Permitting and Registration

2.7.1 Description of Exemptions

2.7.1.1 Exemptions by Well-Type

Per Well Regulation §1802, an infiltration test well constructed and used in accordance with Chapter 5 of Title 21 of the District of Columbia Municipal Regulations (DCMR) and the Stormwater Management Guidebook, shall be exempt from the requirements of the Well regulations. In addition, an infiltration test well only can be used for testing infiltration for stormwater management purposes, and it cannot be used for any other purpose including collecting samples to determine soil or groundwater quality.

Per Well Regulation §1802, a well that is constructed for use in a best management practice (BMP) in accordance with Chapter 5 of Title 21 DCMR and the Stormwater Management Guidebook shall be exempt from the well permit application and registration requirements of the Well Regulations. This exemption does not apply to a stormwater management well to be constructed at a known or potentially contaminated site.

2.7.2 Exemptions for Well Construction

Per Well Regulation §1802, a well construction permit shall not be required for a well which meets all of the conditions from the Well Regulations § 1802.3:

The well is constructed to a depth of 10 ft or less; the lower terminous does not intersect the seasonal water table; is not sited within 25 ft of the mean high watermark of District surface waters; is not sited within 25 ft of wetland; constructed in accordance with the requeriments of the well regulations; and is abandoned within 5 days of completion of construction.

The seasonal water table referenced in section § 1802.3 (b) of the Well Regulation, is refering to the seasonal high groundwater table that is established based on data collected over at least the last two consecutive years from groundwater monitoring wells that are:

a. appropriately located horizontally in the surficial aquifer and screened vertically to intersect groundwater table at the site or at an adjacent site;
b. constructed where there are no appreciable differences in the topography and lithology between the proposed borehole locations and the existing monitoring wells;
c. where no changes have been made to the subsurface conditions (for example, dewatering, injection, or placement of a slurry wall or other obstruction to groundwater flow) since the data were collected that would limit their usefulness; and
d. the monitoring period includes the typical high groundwater season in the District from April to early June.

2.7.3 Conditional Requirements – Well Construction Exemptions

Per Well Regulation §1802, if during the construction of a well for which no building permit was required, field conditions or new information indicate that any condition in it will not be met, the Well Owner shall stop the well construction activities, notify DOEE within 24 hours, propose

immediate corrective actions, implement DOEE ordered corrective actions, and if requested, submit a well construction permit application.

Examples of field conditions or new information that would apply in this section include drilling into the groundwater table; obtaining a wetland delineation that places the new well within the setback boundary or wetland buffer; encountering a pollutant and drilling through it, especially in perched groundwater; encountering an underground storage tank; having a pollutant spill or release that enters the open borehole or leaches into the ground adjacent to the borehole; or installing a small-diameter well that cannot be abandoned properly using a tremie pipe.

2.7.4 Exemptions for Well Maintenance

Per Well Regulation §1802, a well construction permit shall not be required for the maintenance of a registered well, provided that the maintenance does not include a modification to the design or material of the well.

Changes that require a well construction permit to perform maintenance include a change to the upper well terminus such as conversion from a stickup to a flush-mounted well. However, the replacement of bolts, a manhole cover, well cap, the installation of protective bollards, or repairs to the well pad, do not require a well construction permit. Repairs and maintenance not requiring a well construction permit should be conducted as soon as possible, especially if groundwater quality can be impacted.

DOEE must approve a change to the rating of a pump used in a water supply, dewatering, or recovery well as this change may affect the drawdown and radius of influence of the withdrawal which are material changes in the original permitted design of the well. Similarly, the addition of a pump to a well not previously permitted to be used for groundwater withdrawal will require approval by DOEE unless the pump will only be used for well development, or to collect a groundwater sample, or to conduct aquifer testing.

2.7.5 Exemptions for Well Abandonment

Per Well Regulation §1802, a well abandonment permit shall not be required if: the well is abandoned within (30) days of construction, and a well abandonment work plan developed in accordance to the well regulations (§1830 and §1831) is submitted with the initial well construction permit application.

2.7.6 Approved Delays for Well Permitting

Per Well Regulation §1802, once notified by a well owner, DOEE may allow a Well Owner to delay in submitting a well construction permit application in emergency circumstances. Emergency circumstances include those immediately notified to DOEE that may impact the environment, the public health and safety, those that requires immediate corrective action, or the delay would result in an immediate hazard to public health and safety of the environment.

In all cases the application will be made within 72 hours after the emergency and all the work conducted will be in accordance to applicable construction, maintenance, and abandonment requirements.

2.8 Reviews, Inspections and Administrative Requirements

2.8.1 Department Review of Well Construction Permit Applications

2.8.1.1 Department Reviews

Regarding private-Space space Well well compliance, DOEE shall review each Well permit Construction application and associated documentation in accordance with Well well Regulation §1804 (§1804.1 – §1804.8). For additional information, refer to Well Regulation §1804 and to Section 1.3 of this guidance document for additional information on the Private-Space Well Permitting Process through DCRA.

Regarding Public-Space Well Permits compliance, DOEE shall review each public-space well permit application and associated documentation in accordance with Well well Regulation §1804 (§1804.1 – §1804.8). For additional information, refer to Well Regulation §1804 and to Section 1.4 of this guidance document for additional information on the Public-Space Well Permitting Process through DDOT.

2.8.1.2 Estimated Review Timelines

Provided below are estimated timelines presented as business days for reviews of well permitting forms associated documentation that are determined to be administratively and technically complete by DOEE.

The review period for due diligence permit applications is normally 5 business days. The review period for all other well permit applications is 7 to 10 business days.

Well Registration Forms Forms typically can be processed and a meeting scheduled within 24 hours or the next business day.

Per Well Regulation §1804.3 – §1804.7, DOEE may reject a well permit application and associated documentation for the justifications listed below. Such instances have the potential to impact the review timelines for and require resubmission of well permit applications and associated documentation.

- Submission of an incomplete application or work plan per the Well Regulations.
- Violation of District or federal laws or regulations.
- Posing a hazard to the environment or public health and safety.
- Interfering with the designated or beneficial uses of the waters of the District.

2.8.2 Well Inspection Authority and Requirements

Regarding the inspection of well construction, maintenance and abandonment activities as well as other well-related activities, according to the Well Regulations Regulations (§1832), DOEE may

- Access the property where a well is sited;

- and Conduct site inspections;
- inspect and copy any records; and
- Collect soil and water samples.

2.8.3 Administrative Requirements – Well Fee Schedule

In accordance with Well Regulation §1805

- Fees shall be paid in full at the time an application for well construction or well registration is made.
- Fees for instrumentation wells and permanent dewatering wells will be calculated using the fee schedule for a soil boring and recovery well, respectively.
- DOEE may adjust the fees for inflation once every calendar year beginning on January 31, 2017, using the Urban Consumer Price Index published by the United States Bureau of Labor Statistics.

2.8.4 Administrative Requirements – Enforcement and Penalties

With regard to Enforcement and Penalties, DOEE may issue orders to abandon a well if it posess a hazard to public health and safety of the environment, or is not constructed in accordance to the standars of the well regulations, and; orders to stop construction, maintenance or abandonment of a well. Refer to Well well Regulation §1833 for further information on enforcement and penalties.

2.8.5 Administrative Requirements – Appeals and Judicial Review

With regard to Administrative Appeals and Judicial Review, refer to Well well Regulation §1834 for further information on administrative appeals and judicial review.

Section 4.0 Borings – Soil, Geotechnical, Geophysical, and Instrumentation Requirements

Chapter 3 Geologic and Hydrogeologic Overview of the District

3.1 Geologic Overview

The most conspicuous geological feature of Washington DC from the geologic point of view is the Fall line, separating the Piedmont Physiographic province from the Atlantic Coastal Plain Physiographic Province. The Piedmont consists of a group of rocks that were deposited, deformed, metamorphosed, and intruded at different times and locations, and under different conditions. The Piedmont in the Washington DC area is made up of mostly igneous and metamorphic rocks derived from sedimentary and older igneous rocks changed by dynamic and contact metamorphism which occurred during a long geologic period from about 480 to 280 Million Years Ago (Ma). The rocks from the Piedmont were uplifted in the late Paleozoic Era during the Alleghenian Orogeny, and then eroded to a plateau. The Fall Line was formed during extensional tectonics as the Atlantic Ocean opened about 200 Ma (Fichter, et.al. 2010) along with intrusions of igneous rocks forming contact metamorphic rocks. More than 65 million years of erosion, from the Jurassic to Cretaceous, reduced the Piedmont landscape to a plateau. After the rifting that opened the Atlantic Ocean, the continental margin sank below sea level. The seas invaded and eroded the Piedmont plateau rocks to the west and deposited an eastward thickening wedge of generally unconsolidated sediments to form the Atlantic Coastal Plain Physiographic Province, which includes gravel, sand, and clay, ranging in age from Cretaceous to Recent. These sediments vary from a few inches thick at their western extremity along the Fall Line to more than 1,800 feet thick east of the District. The oldest of the Coastal Plain Deposits is from the Early Cretaceous (145-100 Ma) and the most recent are from the late Pliocene (2.5-1.8 Ma) (Southworth and Denenny, 2006). Quaternary fluvial deposits are close to the current drainage systems and include alluvium, low and high terraces, and fluvial estuarine deposits.

Due to the great diversity of rocks and geology of the two Physiographic Provinces, the hydrogeologic characteristics of the geological units greatly vary. At present, limited data suggest that there is not a significant depletion of the groundwater resources of the District. In the Piedmont, the potential yield was shown to be significant, and historically, the City of Rockville was supplied by a groundwater system comprised of 17 bedrock wells capable of providing more than 1,000,000 gallons of water per day (Johnston, 1964). In the Coastal Plain, The Potomac Group (The Patapsco and Patuxent Formations) are the major aquifers. The Surficial Aquifer is not as productive but it is very important as it is the baseflow source of the rivers and creeks. However, it is vulnerable to the contamination, and the urban development has changed its natural regime. It is very important to protect the Aquifers of the District because in the future the present practice of using a major surface-water supply can be supplemented by using groundwater as supplemental public supply or just having a standby groundwater supply for use in emergencies.

3.2 Description of Hydrogeologic and Geologic Units

Four (4) groups of geologic formations, or part of a formation with similar hydrologic characteristics (hydraulic regimes) exist in the District of Columbia:

- crystalline rock aquifer units in the Piedmont;
- perched aquifers in the Coastal Plain;
- surficial aquifer in the Coastal Plain; and
- Potomac Group Aquifers in the Coastal Plain (D.C. Water Resources Research Center, 1993).

The main Potomac Group clay unit in the District (although is not the only clay unit) is the Arundel Clay which is a thick unit and overlies much of the Patuxent Formation which is the deeper of the Potomac Group Aquifer Units.

Each unit has widely varied physical and hydraulic characteristics. The highest transmissivities were found for the Potomac Group Aquifer Units and localized areas within the surficial aquifer. Local flow systems correspond to the surface water drainage basins of the Potomac River, the Anacostia River, Rock Creek and Oxon Run. Local flow systems are affected by sewers and tunneling in the downtown area. Ground water, however, may still follow the natural topographic gradient and discharge directly to the Potomac River. Region flow systems are associated with recharge to the Potomac Group Aquifer or crystalline rock aquifer in or near the Piedmont and both having discharge locations significant distances away typically in the Coastal Plain physiographic providence. Groups of Geologic Formations and General Characteristics are provided in Table 2 below and the Distribution of the Geological Units is presented in Figure 5 below.

Table 1 Groups of Geologic Formations and General Characteristics

Hydrogeologic Units and Geologic Names	Lithology	Hydraulic conductivity	Water Yield	Thickness
		Potomac Group Aquifers		
Upper Patapsco Aquifer	Interbedded clay, silty clay and silt which also contains pockets, lenses and layers of fine sand and gravelly sand	Kh=0.07-38.8 ft/d	Moderate	125-390 ft
Patapsco confining unit	Dark gray and variegated clay, interbedded with fine sand.	Kv=5.9 x 10-7 to 1.47 x 10-6 ft/d	Poor	laterally discontinuous, variable thickness (17-290 ft)
Lower Patapsco Aquifer	Multiple water bearing sands fine to medium sand and gravels interbedded with layers of silty clay.		Good	~20-100 ft
Arundal Clay confining unit	Dark gray to maroon, stiff lignitic clay with siderite concretions, plant remains and dinosaur, reptile, fish and mollusk fossils.	Kv= 0.0013 to 3.2 ft/d	Poor	laterally dicontinuous, variable thickness (18-353 ft)
Patuxent Aquifer	Deposited in a fluvio-deltaic environment, resulting in a series of interestratified gravels, sands, silts, and clays.	Kh=2-192 ft/d	Good	~0-350 ft
		Surficial Aquifers		
Fill, Terrace and Alluvial Deposits includes the Brandywine and Sunderland gravels (Upland terraces), The Wicomico Formation (terraces).	The alluvial deposits consist of gravel, sand, silt and clay of the lowest stream terraces and stream beds. Terraces consist of a mixture of silty and sandy clays with sands and gravelly sands, interlayered and lensed in a complex pattern	7.2 ft/d-720 ft/day	Moderate	~1-25 ft

Crystalline Rock Aquifers (Fractured bedrock aquifers)				
Saprolite overlying:	Saprolite results from chemical weathering of crystalline rock. The saprolite contains water in pore spaces between rock particles.	0.03-3 ft/d	Moderate	Unknown
Kensington Tonalite (Gneiss)	Consists of foliated granodiorite gneiss that contains augen and coarse porphyroblasts of microcline. The tonalite is light gray, coarsegrained, and well foliated, with muscovite and biotite and locally garnet.	0.03-3 ft/d	Moderate	unknown
Georgetown Mafic Complex	The suite is composed of gabbro and three varieties of tonalite. Garnetiferous biotite-hornblende tonalite is a dark-gray, coarse-grained well-foliated to gneissic rock.	0.03-3 ft/d	Moderate	unknown
Laurel Formation	Rocks of the Laurel Formation have a matrix of quartz and feldspar that support fragments, elongate cobbles, and bodies of meta-arenite and muscovite-biotite schist. Its origin is a sedimentary mélange	0.03-3 ft/d	Moderate to good	unknown
Sykesville Formation	Is a sedimentary mélange consisting of a gray matrix of quartz and feldspar that supports distinctive rounded and elliptical white and clear quartz cobbles, and blocks of dark gray phyllonite, light gray migmatite and metagraywacke, and dark green-ish black mafic, ultramafic, and metagabbro rocks, and light gray metafelsite and plagiogranite.	0.03-3 ft/d	Moderate to good	unknown

Sources: D.C. Water Resources Research Center; 1993; Logan, 1999; Andreasen et.al., 2013; and Johnston, 1964.

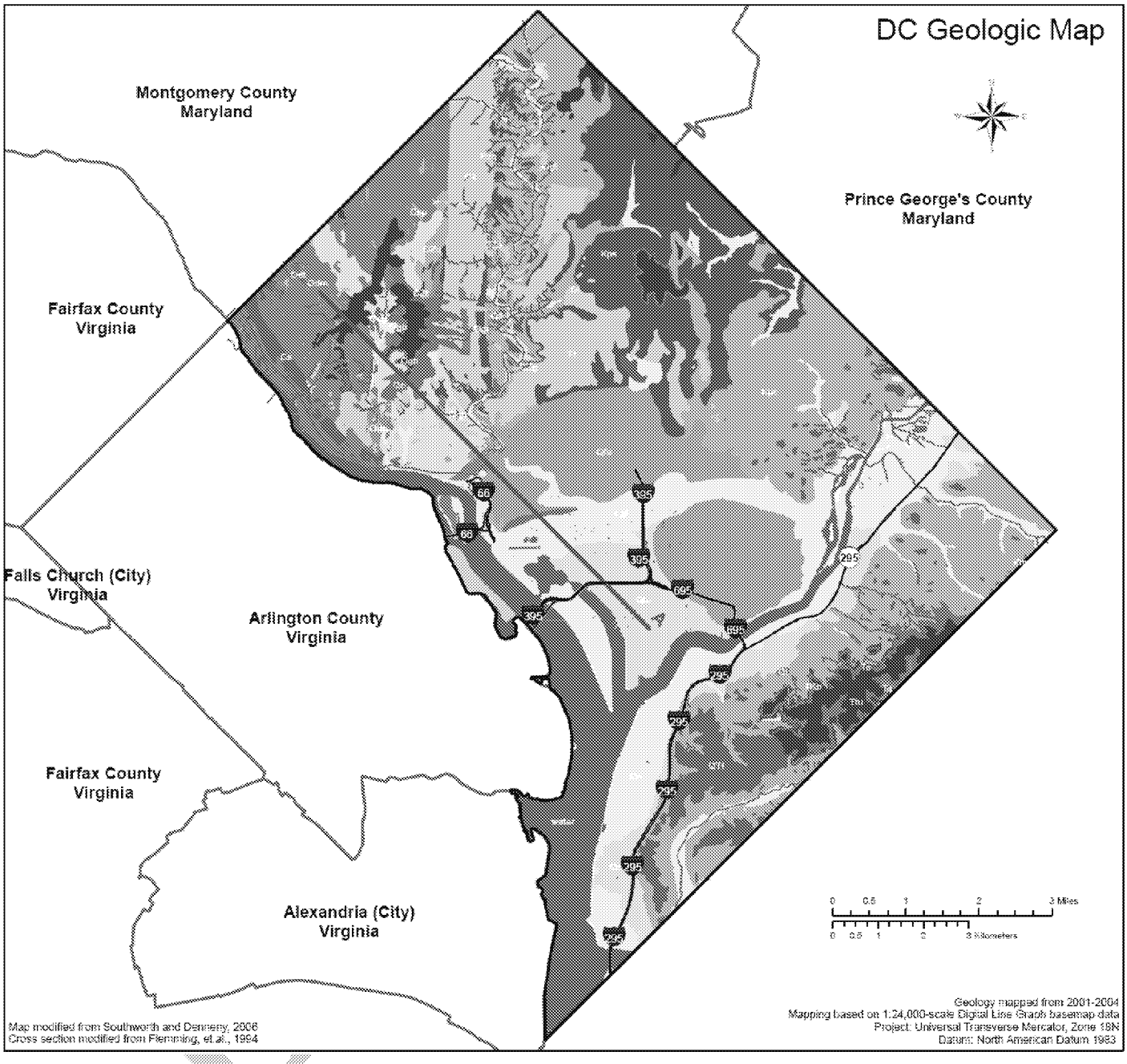


Figure 5 District of Columbia geological map.

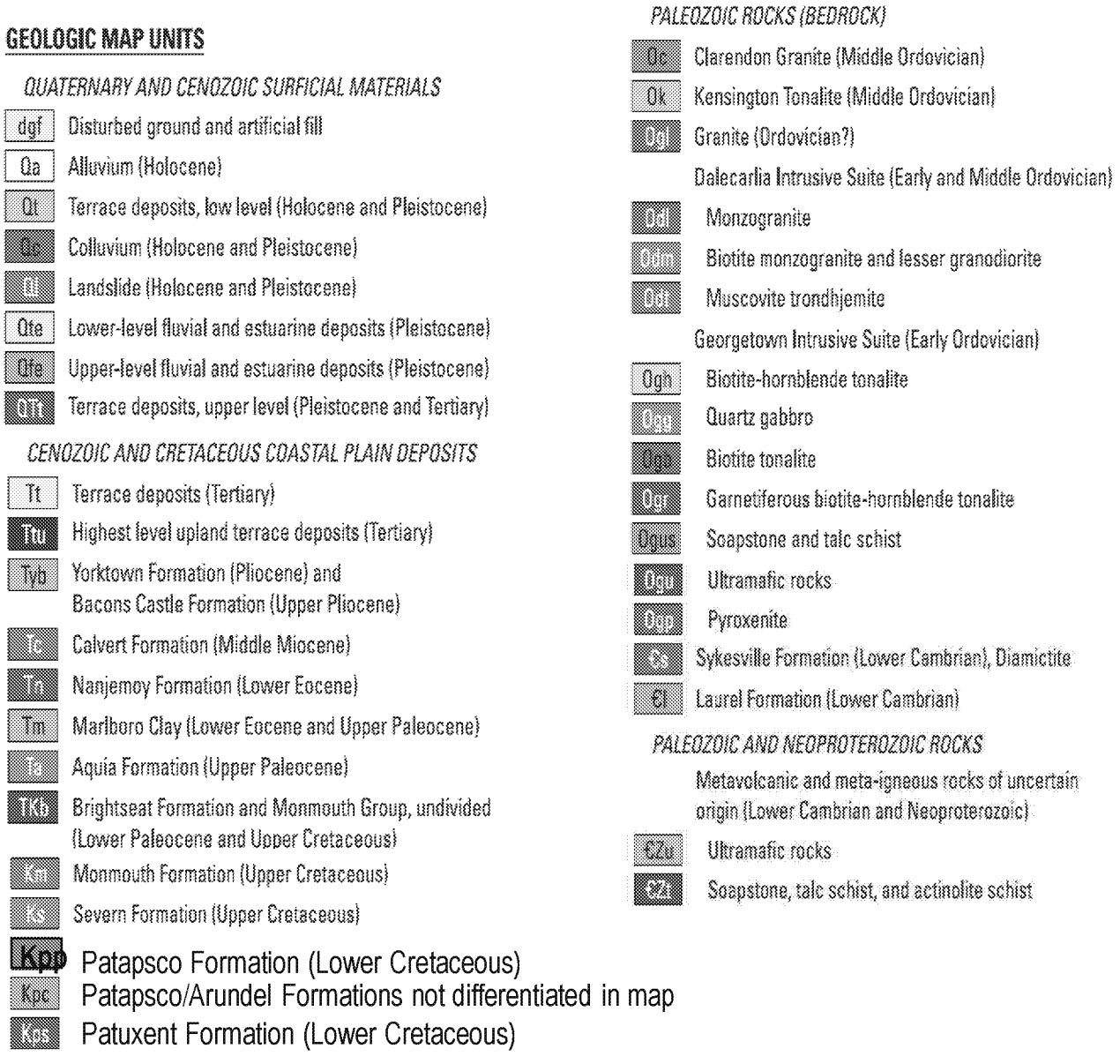


Figure 5 Legend for District of Columbia geological map.

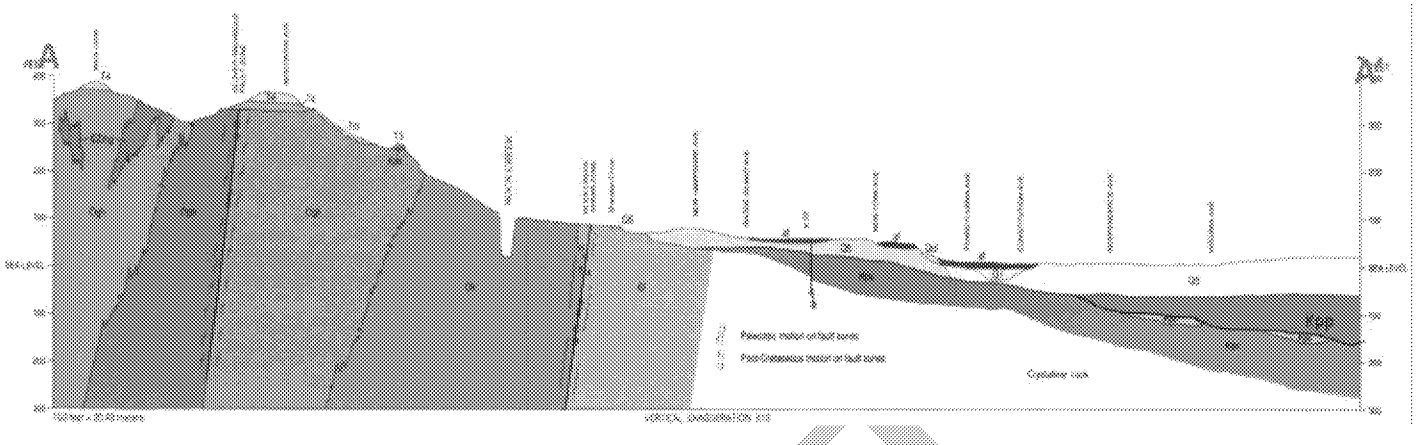


Figure 7 Geologic cross section A-A.

3.3 Description of Environmental Susceptibility and Contaminant Migration

The District's hydrogeological regimes have been ranked for environmental susceptibility to contamination (D.C. Water Resources Research Center, 1993). The Potomac Group aquifers have very good water quality and quantity and are used as water sources in the District and in adjoining jurisdictions. The Potomac Group aquifers are also the most likely aquifers to be developed as a water supply within the District of Columbia and therefore, the protection of these aquifers should be given the highest priority. In general, ambient water quality is good but elevated iron concentrations may be present from natural leaching. Potential for contamination from underground storage tanks is high where the Potomac Group clay is thin. Deep groundwater flow from these aquifers upwells into the major streams (Potomac and Anacostia Rivers) especially where the Arundel Clay is thin or missing beneath the river channels. Therefore, any contaminants entrained in the discharge will degrade the receiving water body.

The surficial aquifer and the crystalline rock aquifer are highly susceptible to contamination where zones of high hydraulic conductivities are present due to preferential pathways, such as buried stream channels or interconnected fractures. Water quality, particularly in the surficial aquifer, shows some signs of degradation due to urban activities, but rarely show exceedances of the District's Groundwater Standards in places where wells to characterize natural background were installed (Southworth and Denenny, 2006). The surficial aquifer provides baseflow to the District's streams and other surface water bodies and is a critical component in the District's efforts to ensure that the designated uses are achieved and maintained. Sand and gravel fluvial deposits form a widespread layer in many areas adjacent to and in historic streams, such as Tiber Creek which may now be buried to form paleochannels. These deposits also occur along the Anacostia and Potomac Rivers. When encountered, they typically are highly transmissive units and can be significant conduits for contaminant flow.

The Potomac Group main clay confining unit, known as the Arundel Clay, has a vertical hydraulic conductivity of 1 x 10-13 cm/s (Andreasen et.al., 2013) in parts of Maryland and assumed to have the same value in the District. As such, it is a very protective layer even when it is found as a relatively thin unit in the subsurface. Although the Arundel Clay is sometimes grouped with the Upper and Lower Patapsco Formations as a single unit, its hydrogeological

properties especially the horizontal and vertical hydraulic conductivities are expected to be significantly different from these other formations. Large parts of the downtown area have interbedded sand and clay lenses which create perched water tables that can complicate the determination of groundwater flow directions. In addition, as this area also coincides with many of the contaminated sites, the perched groundwater may be a source of contamination that can impact dewatering operations and limit the effectiveness of remedial actions. Drilling operations in this area should include protective measures such as the use of appropriately constructed outer casing to prevent the movement of pollutants in the subsurface.

3.4 Drilling Operations and Protection to the Groundwater from the District

The following figure shows a generalized conceptual hydrogeological model of the District of Columbia, the types of wells to encounter during drilling operations, and the required protection for each type of well is explained is presented in the following table (a detailed decision tree is included in Appendix A).

Well Type (See figure 8)	Protection required if upper layer is contaminated	Protection Required if upper layer is clean and an upper clay unit is present	Protection required if upper layer is clean and a upper clay unit is not present	Protection required if the well penetrates different aquifers and the upper layer is clean
1 Unconfined Aquifer	Grouted Permanent Outer Casing	Optional Temporary Outer Casing	Optional Temporary Outer Casing	Optional Temporary Outer Casing
2 Bedrock/Saprolite Aquifer	Grouted Permanent Outer Casing	Optional Temporary Outer Casing	Grouted Permanent Outer Casing	Optional Temporary Outer Casing
3 Perched Aquifer	Grouted Permanent Outer Casing	Optional Temporary Outer Casing	Grouted Permanent Outer Casing	Optional Temporary Outer Casing
4 Confined Aquifer	Grouted Permanent Outer Casing	Optional Temporary Outer Casing	Optional Temporary Outer Casing	Grouted Permanent Outer Casing
5 Artesian Confined Aquifer	Grouted Permanent Outer Casing	Optional Temporary Outer Casing	Optional Temporary Outer Casing	Grouted Permanent Outer Casing

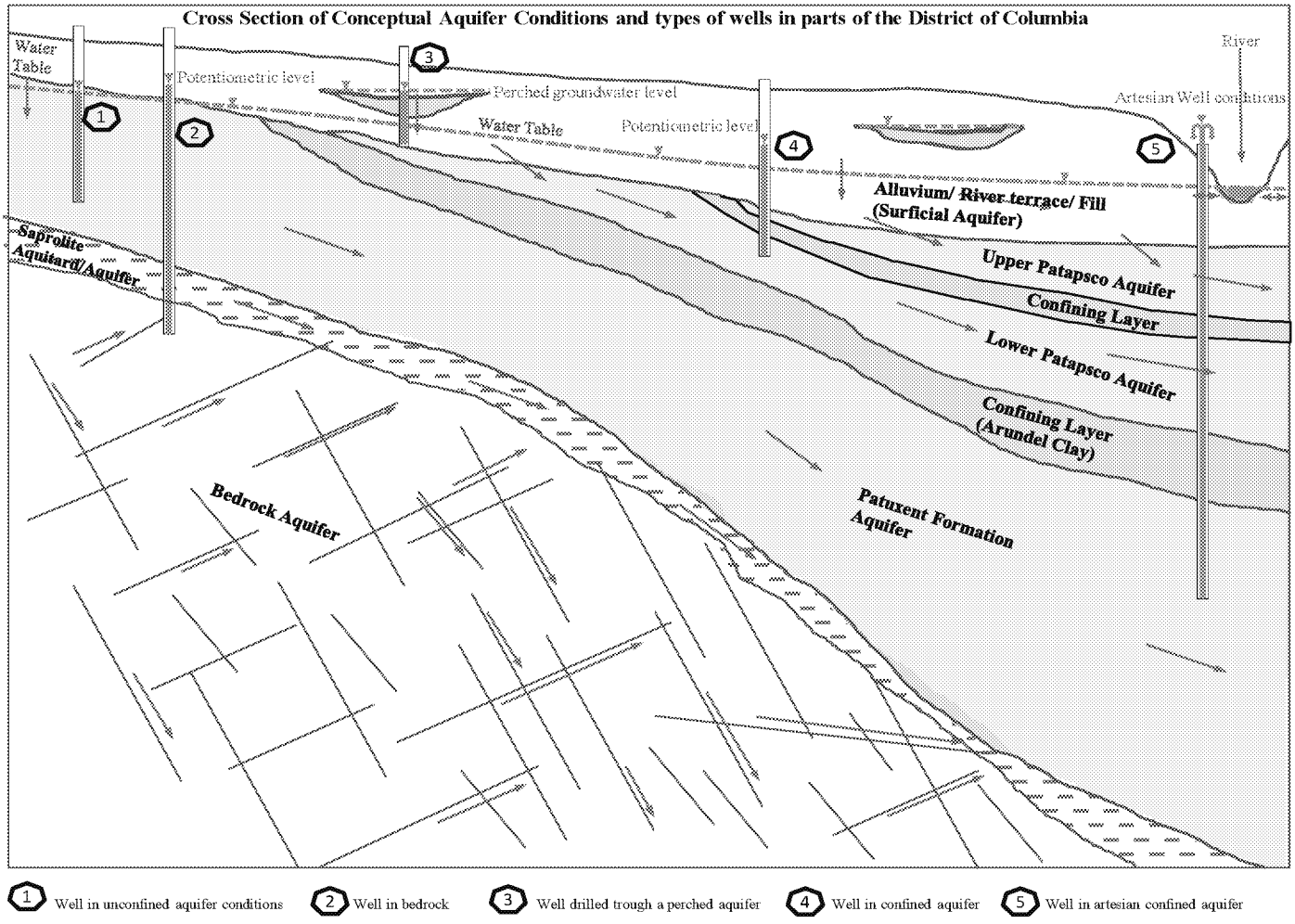


Figure 6 DOEE's Conceptual hydrogeologic model showing most of the possible conditions to encounter during well installation in the District as explained in Table 3.

Chapter 4 Borings – Soil, Geotechnical, Geophysical, and Instruments

4.1 Definition and Purpose

A boring is a hole drilled to achieve one or more of the following purposes:

- Investigate, field test, characterize, measure, sample, and test soil, rock, and groundwater
- Provide access to sample, measure, and collect the physical and chemical parameters of groundwater, soil, and rock
- Install geotechnical, geophysical, and groundwater monitoring instruments

The District issues well construction permits for four categories of borings: soil boring, geotechnical boring, geophysical boring, and instrumentation boring.

Soil Boring – A hole drilled to measure or collect samples to determine the physical or chemical characteristics of soil, sediment, rock, or groundwater.

Geotechnical Boring – A hole drilled to determine or test the soil strata. A geotechnical boring is used as part of a geotechnical investigation to assess soil strata stability, compressibility, strength, or other material and subsurface characteristics that have the potential to influence construction and infrastructure.

The most common types of geotechnical borings (see Figure 9):

- Standard penetration test (SPT)
- Cone penetration test (CPT)
- Piezocone penetration test (CPTu)
- Flat dilatometer test (DMT)
- Pressuremeter test (PMT)
- Vane shear test (VST)

Each type of test applies different load schemes to measure the corresponding soil response to evaluate material characteristics such as strength or stiffness.

A rotary drilling rig or a hollow stem auger rig and crew are essential for these tests. In the case of the CPT, CPTU, and DMT, no boreholes are needed, thus termed "direct-push" technologies. As such, these may be conducted using standard drill rigs, direct-push rigs, or mobile hydraulic systems (cone trucks) in order to directly push the probes to the required test depths. A disadvantage of direct-push methods is that hard cemented layers and bedrock will prevent further penetration. In such cases, borehole methods prevail as they may advance by coring or noncoring techniques. An advantage of a direct-push probe is that no cuttings are generated, however disposal of contaminated material must comply with all Investigated Derived Waste (IDW) requirements.

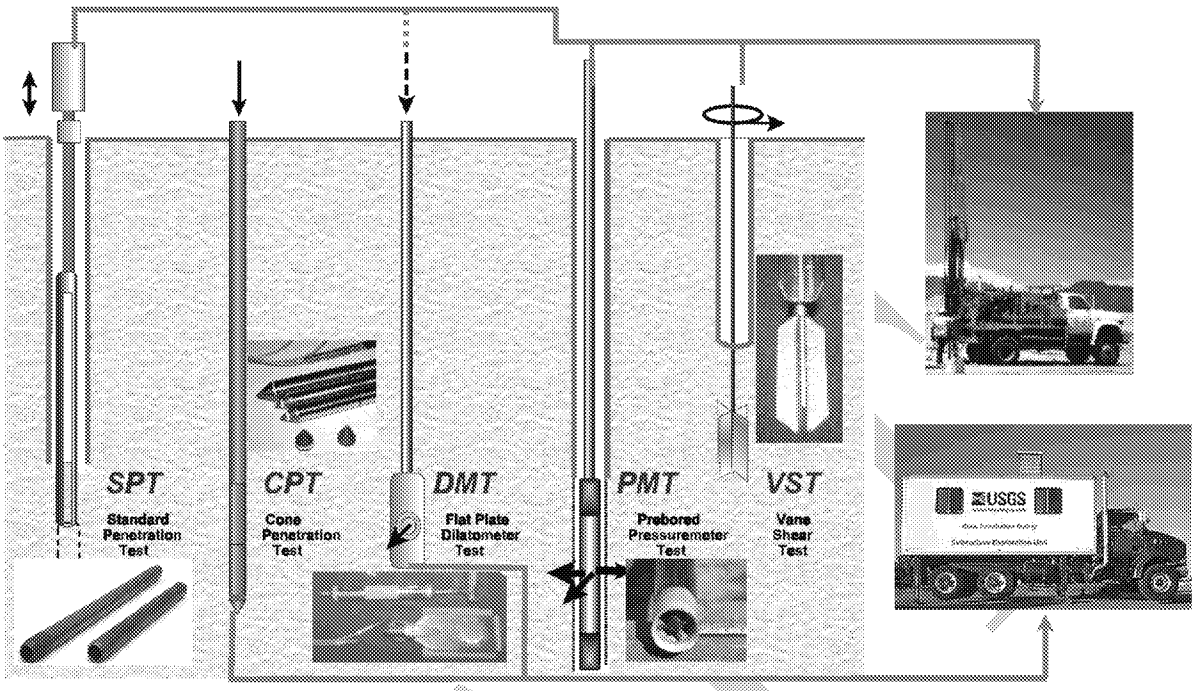


Figure 9 Common geotechnical borings for soil characterization (Modified from NHI, 2002).

- Cone penetrometer boreholes - Cone penetrometer boreholes or standardized cone penetrometer test (CPT), The test is performed according to ASTM D-3441 (mechanical systems) and ASTM D 5778 (electric and electronic systems) and consists of pushing a cylindrical steel probe into the ground at a constant rate of 20 milimeters per second (mm/s) and measuring the tip resistance (qc) and sleeve resistance (fs) to penetration. The standard penetrometer has a conical tip with 60° angle apex, 35.7-mm diameter body (10-centimeter squared (cm^2) projected area), and 150-cm^2 friction sleeve. The ASTM standard also permits a larger 43.7-mm diameter shell (15-cm^2 tip and 200-cm^2 sleeve). The CPT can be used in very soft clays to dense sands, yet is not particularly appropriate for gravels or rocky terrain (NHI, 2002).
- Bedrock Borings - Where borings must extend into weathered and unweathered bedrock formations, rock drilling and sampling must be conducted. Defining the top of bedrock during drilling operations can be difficult, especially where large boulders exist, and below irregular residual soil profiles. In all cases, core drilling procedures are used when formations are encountered that are too hard to be sampled by soil sampling methods. A penetration of 25 mm (1 in) or less by a 51 mm (2 in) diameter split-spoon sampler following 50 blows using standard penetration method energy indicates that soil sampling methods are not applicable, and rock drilling or coring is required. Types of core barrels may be single-tube, double-tube, or triple-tube. The standard is a double-tube core barrel, which offers better recovery by isolating the rock core from the drilling fluid stream and consists of an inner and outer core barrel. Rock coring can be accomplished with either conventional or wireline drilling equipment. With conventional drilling equipment, the entire string of rods and core barrel are brought to the surface after each core run to retrieve the rock core. Wireline

drilling equipment allows the inner tube to be uncoupled from the outer tube and raised rapidly to the surface by means of a wire line hoist.

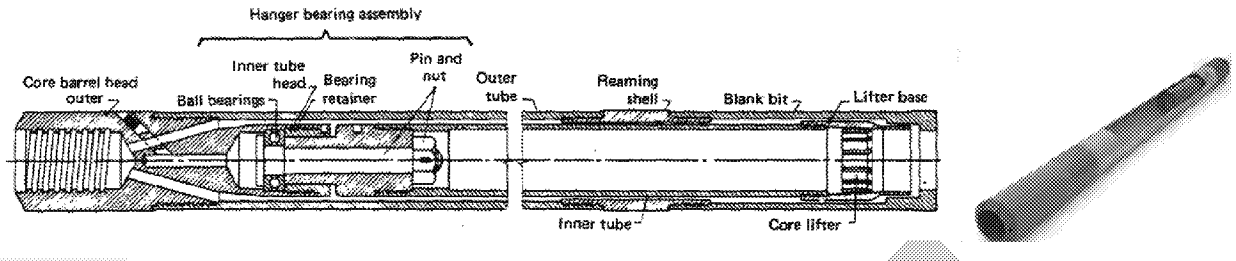


Figure 10 Double-tube corel barrel for rock coring (NHI, 2002)

Geophysical Boring – A hole drilled to introduce probes or instruments to investigate, record, or measure physical properties of the soils and rocks. Borehole geophysics collects geologic and hydrogeologic information in boreholes and wells by lowering and raising probes on a wire. A standard suite of borehole geophysics includes:

- Caliper – Provides a continuous record of average borehole diameter, it is used to identify fractures, water-bearing openings, and changes in lithology.
- Natural gamma – Records the natural gamma radiation emitted from rocks penetrated by the borehole. The gamma log often is used to define lithology and correlate geologic units between boreholes.
- Single-point electric – Electrical resistance increases with grain size and decreases with borehole diameter, density of water-bearing fractures, and increasing dissolved-solids concentration of borehole fluid
- Fluid resistivity – Measures the electrical resistance (fluid conductivity) of fluid in the borehole. Logs reflect changes in the dissolved-solids concentration of the borehole fluid.

- Fluid temperature – Provides a continuous record of the temperature of the fluid in the borehole.

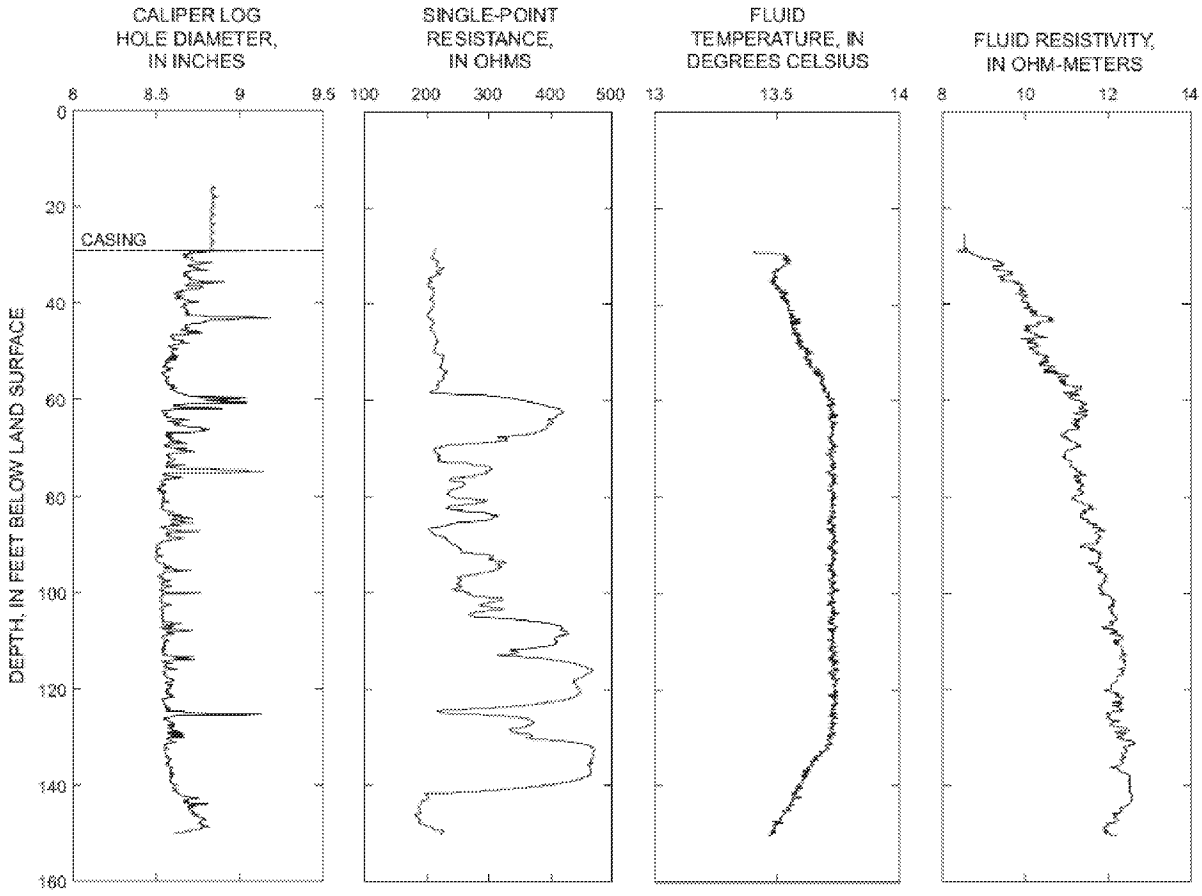


Figure 11 Logs obtained by the Caliper, Natural Gamma, Fluid Temperature, and Fluid Resistivity. USGS, 2005.

- Flowmeter – Measures rate and direction of borehole flow under static conditions; measures contribution of individual fractures under pumping conditions; differences in hydraulic head; delineates transmissive fractures; and defines relative vertical hydraulic gradients.

Figure 12 Heat-pulse flow-meter tool (USGS, 2017).

- Television – Borehole television.
- Acoustic televiewer – The acoustic borehole televiewer log is a magnetically oriented, 360°, photograph-like image of the acoustic reflectivity of the borehole wall. Digital images from the televiewer are recorded by the computer collecting logging data.

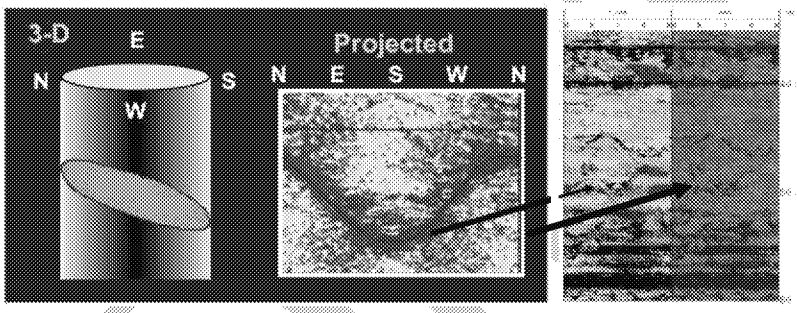


Figure 13 This image illustrates how the Televiewer logs indicate the location and strike and dip of fractures and lithologic contacts (USGS, 2016).

- Optical televiewer – The Optical televiewer (OTV) uses a ring of lights to illuminate the borehole, a charge-coupled device (CCD) camera, and a conical or hyperbolic reflector housed in a transparent cylindrical window. Commonly used OTV tools are 1.4 – 2.8 meters in length and 40 – 50 mm in diameter. The CCD camera measures the intensity of the color spectrum in red, green, and blue. The reflector focuses a 360° slice of the borehole wall in the camera's lens. Light intensity is either preset prior to logging or, in some systems, may be adjusted while logging. The optical image scan is either sent up the logging cable as an analog signal and digitized uphole or digitized downhole and sent up as a digital signal

- Cross-Hole Electrical Tomography Borehole – Engineering projects widely use electrical resistivity tomography (ERT) with down-hole electrodes, single-hole ERT (SHERT), or cross-hole electrical resistivity tomography (CHERT).

Boreholes previously drilled for geotechnical investigations are sometimes used to conduct tomography. Polyvinyl chloride (PVC) or high density polyethylene (HDPE) casing or liners are installed in the existing borehole. In other cases boreholes are drilled. CHERT is used for two-dimensional, cross-hole resistivity tomography to design remedial actions below foundations, monitor an excavation-damaged zone with rings of electrodes inside tunnels, for mineshaft imaging, and to detect weak and fracture zones during underground construction. Geophysical time-lapse measurements provide insight into ongoing subsurface processes. Permanently installed electrodes facilitate long-term monitoring of subsurface structures, such as tunnels, to monitor possible unexpected drilling damage with a tunnel boring machine (Bellmunt, et.al. 2012).

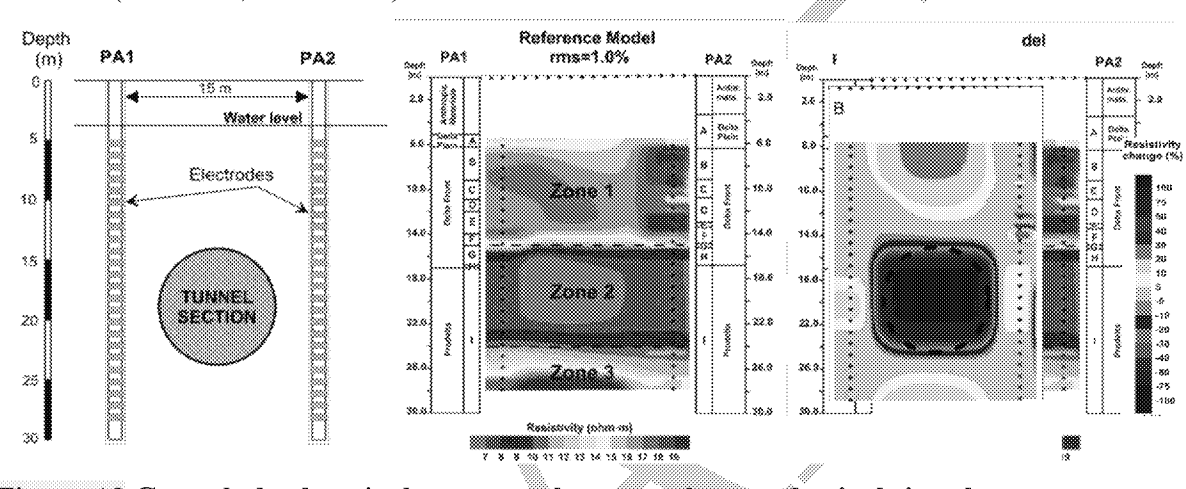


Figure 18 Cross-hole electrical tomography example: geophysical time-lapse measurements define the resistivity change induced during a tunnel construction.

- Cross-Hole Seismic Tomography Boreholes – Cross-hole seismic data can help determine in-situ elastic parameters, and is the closest approximation to the initial tangent shear modulus (G_{max}). This data is particularly useful in dynamically loaded foundation design. This method also provides high resolution imaging of geological structures and cavities.

  Cross-hole seismic measurements require the installation of test boreholes at the desired investigation depth. According to the American Society for Testing and Materials (ASTM) standard, cross-hole seismic tomography boreholes should be lined with plastic casing with a minimum internal diameter of 85 mm to alow deployment of geophysical tools.

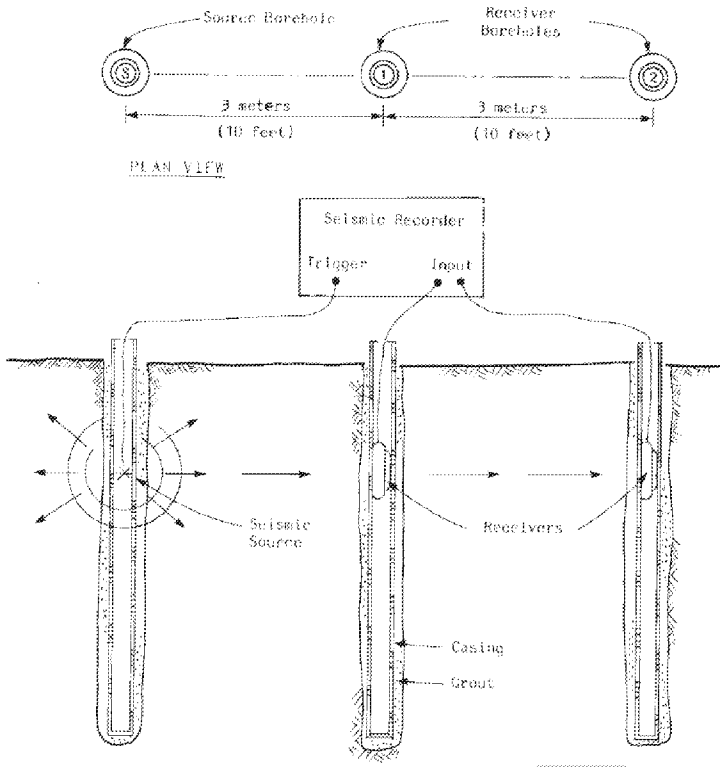


Figure 10 Distribution of borings and devices used for cross-hole seismic tomography (ASTM, 2004).

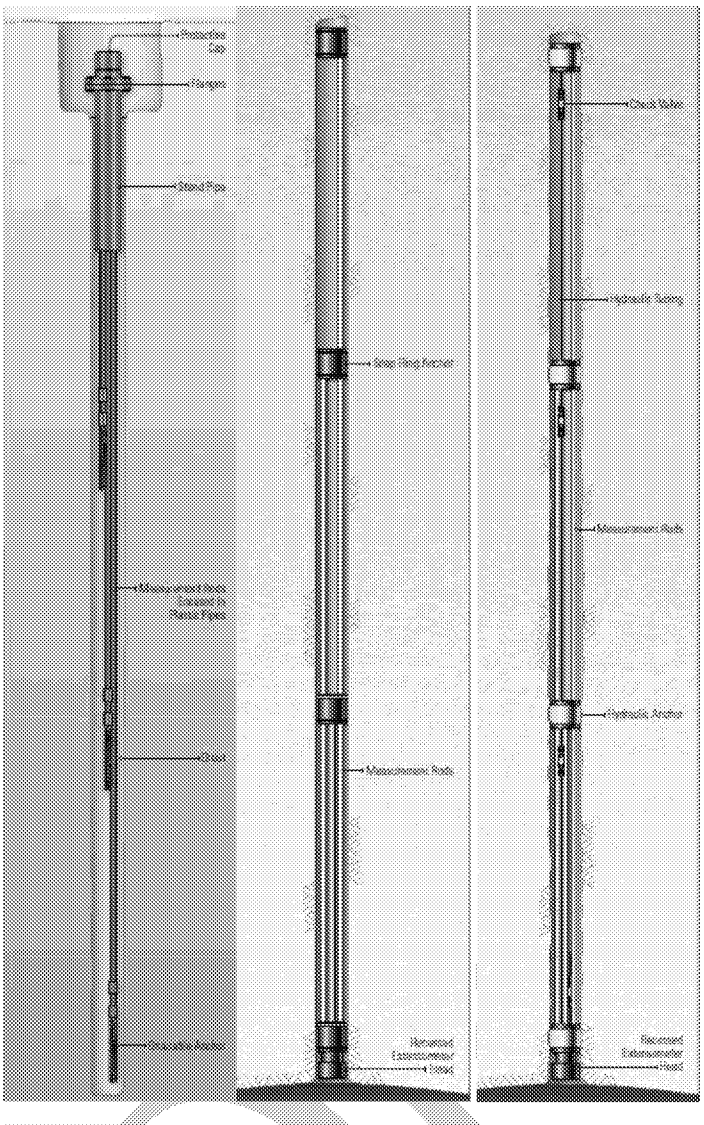
Instrumentation – Inclinometers, extensometers, and vibrating wire piezometers (VWP) are frequently installed in the borings drilled in the District.

Inclinometer – is used to measure the inclination angle of something against the horizontal plane. An inclinometer is defined as a well by the District and therefore requires a Well Construction Permit. An inclinometer can be installed in boreholes lacking a well casing, requires an inclinometer casing specifically constructed with inclinometer sensor tracks.

Geokon, 2017

Figure 11 Examples of installed inclinometers and associated equipment

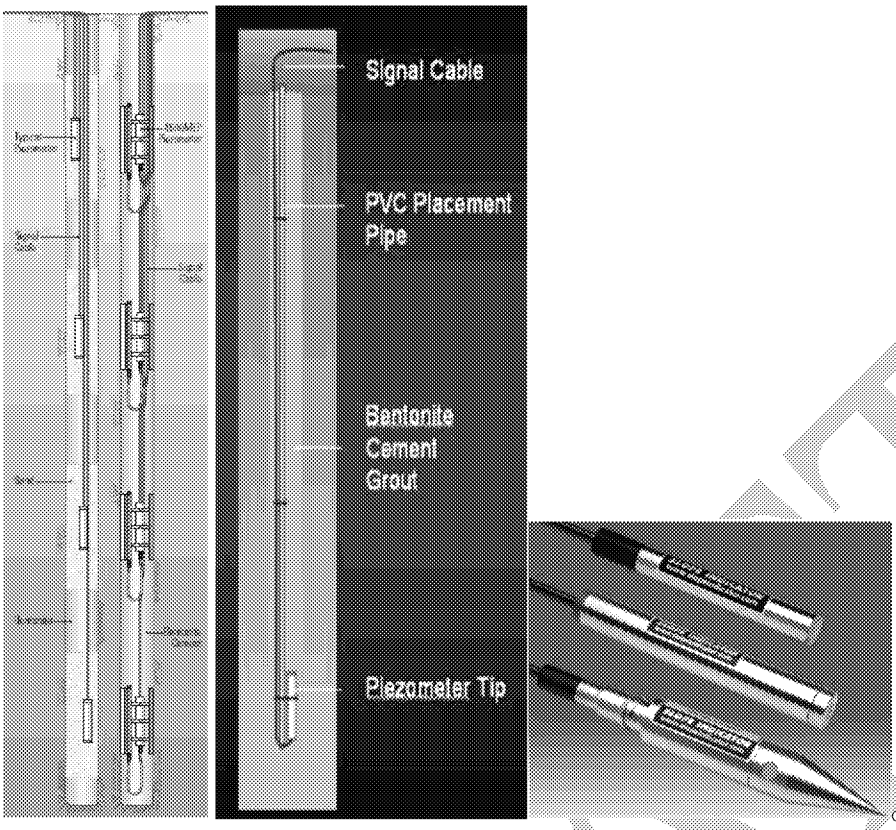
Extensometer – is used to measure deformation of materials under stress. An extensometer is defined as a well by the District and requires a Well Construction Permit. An extensometer is installed in a borehole (lacking casing) with or without grouted anchors depending on subsurface conditions and site application. Extensometer manufacturer installation specifications may deviate from Well Regulation construction requirements, particularly at sites where vertical migration of contaminants is to be avoided. Deviations should be noted in the Well Construction Permit Application and Work Plan.



Geokon, 2017

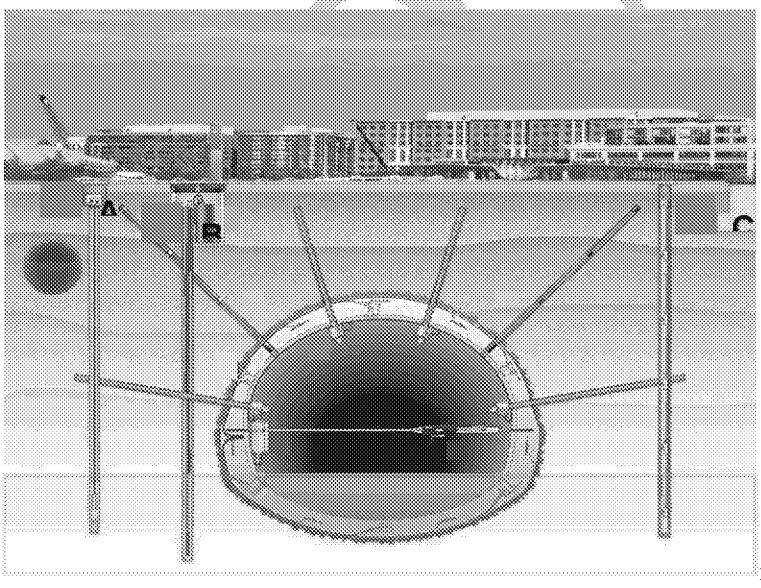
Figure 12 Three types of extensometers: the left used for unconsolidated materials, the middle and right for consolidated materials such as bedrock

Vibrating Wire Piezometer – is used to measure static pressures. VWPs are considered wells by the District and require a Well Construction Permit. VWPs can be installed in open boreholes (lacking casing) or in cased wells equipped with a well screen and typically do not require well development.



Geokon and Durham Geo-Enterprises, 2017

Figure 13 Left and middle are illustrations of multilevel vibrating wire piezometers; a photo of an instrument is on the right



Modified from Geokon, 2017

Figure 14 Use of three common instruments installed in borings for a tunnel construction, A - Vibrating Wire Piezometer, B - Extensometer, C - Inclinometer

4.2 Well Construction Process

4.2.1 Applicability Standards

Any boring or instrumentation well must be constructed in accordance with a submitted Well Construction Work Plan. The applicant must provide two (2) full business days' notice to DOEE prior to commencing well construction activities and obtain public utility clearance of underground facilities with non-utility operators.

DOEE approval may be subject to additional conditions if the use of an outer-casing during the construction of a soil boring is required. The same applies for the grouting of certain geotechnical instruments or geophysical borings.

Lithological and geophysical boring log data or additional analyses may be required to determine District water resources impact.

If the intended use of the soil boring is identified in the Department-approved well construction permit application and well construction work plan, and the soil boring is abandoned within 24 hours of starting construction of the borings, borings and instrumentation wells are not subject to the construction standards detailed in Well Regulations §1809.6 and §§1815 through 1826.

4.2.2 Drilling

Drillers

All well activities requiring the use of a drilling rig (drilling, construction, maintenance, and abandonment) require the supervision of a licensed well driller. The District has not implemented a driller certification program; a driller license from any state is acceptable. The driller approved at the Well Cosntruction work plan has to be maintained to perform the work up to completion unless, prior notification of driller's change is submitted to DOEE and the licenses of the new driller are submitted along with the notice. An amendment to the well permit will be made after DOEE's approval for the new driller to be allowed to perform the job.

Acceptable Drilling Methods

The well permit applicant must provide a complete Well Construction Work Plan that includes an appropriate drilling method for site-specific conditions. These include recognized environmental conditions (RECs), the suspected contamination depth to groundwater, perched water zones, and soil cohesiveness.

DOEE reserves the right to make determinations regarding acceptable drilling methods.

Unacceptable Drilling Methods

Drilling methods for well installation that cannot advance a temporary or permanent outer-casing during drilling, or that are subject to borehole collapse, are considered unacceptable when any of the following conditions are present:

- Sites where known contamination or RECs are present;
- Borings that penetrate perched water or the groundwater table;
- Wells with strong upward gradients (artesian flow); or
- Wells in non-cohesive soils.

Bucket auger and well jetting are examples of drilling methods not recommended for these conditions (EPA, 1993). Neither method can advance a casing, nor do they meet the regulatory requirements for proper well construction. Drilling methods that cannot adequately advance through hard materials such as gravel, rock, and tight clays should also not be used. Hollow-stem auger rigs withouth previous outercasing in the shallow aquifer and bucket augers are not suitable for drilling through Arundel Clay in the District.

Direct mud rotary drilling, while typically suitable for use in the Arundel Clay, can exacerbate the vertical movement of pollutants in the subsurface. A mud rotary drill rig needs to use casing advancement such as a drill through casing driver or dual rotary advancement as a pollution preventative measure at the contaminated site, or where a groundwater contaminant plume is known or suspected to be present.

Borings in Cohesive and Non-Cohesive Materials

A borehole in cohesive subsurface materials that does not have a casing installed as part of the construction process must have a large enough diameter to allow placement of a tremie pipe and appropriate grout during the abandonment process. Well drilling methods that do not allow proper well abandonment procedures in accordance with District Well Regulations are prohibited. Borehole well collapse is not an acceptable abandonment process. Destroying borings during construction activities at the construction site where it is located, is also an unacceptable borehole abandonment method.

If the borehole is collapsing, the well owner must ensure collapse is complete if the subsurface materials are non-cohesive, a REC is not at the site, or the borehole is above the water table. If the collapse is not complete, the owner is responsible for filling any void spaces with an appropriate grout.

Use of Drilling Fluids

All drilling fluids used in the District must use only potable water to create a water-based drilling fluid. The use of additives must be approved by DOEE in the well construction permit application by demonstrating that the additive does not pose a hazard to public health, environment, and safety.

4.2.3 Construction

Upper terminus

Any construction conditions that require the following must be detailed in the Well Construction Permit Application and Well Construction Work Plan:

- Well cap
- Upper terminus
- Well casing
- Grout within the annulus between the borehole wall and well casing

The applicant must comply with all relevant requirements of the District Well Regulations that apply to the boring or instrumentation well.

Cross Contamination Design Specifications

A well must not hydraulically connect otherwise confined aquifers thereby causing aquifer cross-contamination, or hydraulically connect portions of a single aquifer where contaminants exist in separate definable layers within the aquifer. Temporary or permanent outer casings are required during well construction to prevent aquifer cross-contamination at a contaminated site. The use of temporary or permanent outer casings is determined based upon the type and location of the contamination at a site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, a well owner is required to install a temporary outer casing when the drilling method does not include a dual casing and drilling fluids are used to create the borehole (e.g., direct mud-rotary drilling).

Due to the geologic complexity of the District, the conditions of a site can complicate drilling or the selection of target zones for instrumentation. Geological factors can produce aquifers that are anisotropic. In an anisotropic aquifer, groundwater moves faster in one direction than another and oblique to the hydraulic gradient. Anisotropy can result from various sedimentary or structural features such as buried channels, bedding planes, folds, faults, and fractures. In the District, most groundwater flow is either through fractured rocks from the Piedmont or granular materials from sedimentary rocks belonging to the Coastal Plain. Fracture flow in Piedmont bedrock requires additional considerations compared to flow in unconsolidated materials from the Coastal Plain. It is important to consider these differences when drilling borings.

Bedrock may exhibit small effective porosities and low hydraulic conductivities that impede groundwater flow. However, the development of secondary porosity may allow substantial flow of groundwater through fractures, joints, cleavage planes, and foliations. These features tend to be highly directional, exhibit varying degrees of interconnection, and may produce local groundwater flow regimes that can be different from the regional trends. The sedimentary bedding planes and distribution and nature of the Coastal Plain have significant effects on groundwater flow, presenting a series of aquifers and aquitards at different depths. The recent sedimentary deposits (alluvium, artificial sill, and fluvial terraces) and the weathered bedrock (saprolite) conform most of the District unconfined aquifer, including perched groundwater conditions in the Coastal Plain area of the District. It is important to understand the characteristics of the District's hydrogeologic system before designing any soil boring and instrumentation in order to avoid undesirable impact to the aquifers.

Contaminated deeper aquifers under confining pressure (resulting in upward vertical gradients) that are penetrated during drilling require adherence to specific protocols. A permanent outer casing should terminate in a confining unit above the contaminated zone. This casing will be grouted and allowed to set prior to advancing the borehole into the contaminated zone. The outer casing will maximize chances of controlling artesian flow, contain the flow within a casing if drilling fluid weight is insufficient to overcome the pressure of the flow, and stabilize the soil around the wellhead. Management of contaminated derived waste (e.g., cuttings and fluids) then becomes a requirement. The use of a down-hole packer or water-tight well cap may be required if artesian flow occurs to minimize the volume of contaminated water discharging from the well.

The annular space between the outer casing and well casing should be grouted. Bentonite slurry grouts have little ability to resist axial forces that can displace the grout seal in artesian flow, making bentonite grouts unsuitable for high hydraulic gradient sealing locations where strength is important. Bentonite chips or a mixture of bentonite and cement can be used depending on site conditions.

Appendix B contains the DC Hydrogeologic Zones and a decision tree for well construction at uncontaminated or contaminated fill/alluvium sites, and well sites in the Potomac Group and bedrock. Use of temporary or permanent outer casings in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Boring Location and Relocation

Wells must be accessible for maintenance, inspection, and abandonment, and cannot be constructed within or under any building. A utility clearance study is needed to locate utility lines. Pre-existing subsurface structures (e.g., tunnels, diversion sewers, metro) must be identified.

If the well is sited within the 100 year floodplain or other flood prone area the top of the well head must be at least 24 inches above the finished grade and fully protected from surface water intrusion. A well must be located a minimum of 25 feet of the higher watermark of any water body of the District or wetland.

A permitted well can be reolocated to avoid utility lines or other obstacles if it is moved 10 feet or less from the approved location and is on the same lot and square number. Relocation to short distances larger than 10 feet may be reconsidered upon a request demonstrating that the new location does not change the original geologic and environmental conditions of the original permit, and the borings/wells design will remain the same. A formal request (statement letter signed by the well owner) should be submitted to DOEE with all the support information. If approved the relocation an amendment will be made to the original well permit. Otherwise, the applicant will have to reapply for a new well permit on the new location.

Sanitary Protection

Sanitary protection measures must be installed and protective measures taken for each geotechnical/geophysical/instrumentation boring during construction to protect the boring and any water-bearing formation against contaminants from any source including surface water drainage. If contaminants not addressed in the well construction permit are found during drilling the well owner must stop well construction, notify DOEE, and follow Well Regulation procedures. A boring or well must be covered and protected from surface water drainage, vertical migration of contaminants, and other materials when not in use. All materials, including drilling fluids or muds, used in the construction of a well must be free of contaminants and adhere to District and Federal laws and regulation.

4.2.4 Schematics

DOEE developed two well schematics based on regulations for borings to facilitate construction permit applications. The use of only one schematic for multiple wells is allowed if the design specifications and depths are exactly the same for each boring or instrument to be drilled or installed. Otherwise, a different schematic must be used for each design. If instruments, liners, or other components will be installed in the borings, the District requires that the corresponding schematic fields contain the type, depths, and other relevant specification.

In situations where the boring is located in western parts of DC where bedrock is near or at the surface, or in areas where bedrock is expected to be reached and the outercasing will terminate on top of it, the Soil/Geotechnical/Geophysical/Boring Schematic with Outer Casing extended to Bedrock (Figure 15) should be used.

If the boring will reach bedrock but the outer casing is inserted and terminates into the confining unit of the granular formation above it, the Soil Geotechnical/Geophysical Boring with Outer casing Inserted into the confining Unit (Figure 16) should be used. The depth to weathered bedrock and the top of bedrock must be annotated. This schematic must also be used in situations where the boring will reach the main granular DC Aquifer (i.e. Potomac Group, or any similar aquifer unit above the bedrock: see Chapter 3). This Schematic is particularly important when the boring will be drilled in a contaminated area. Well Regulations specify an outer casing be inserted ten feet into the confining layer if the thickness of the confining layer allows it. If the thickness of the confining layer is thinner than ten feet, the schematic must report the expected thickness of the confining unit, and the design should specify the thickness to be penetrated by the outercasing to avoid connecting the shallow polluted aquifer with the underlying granular unit or aquifer.

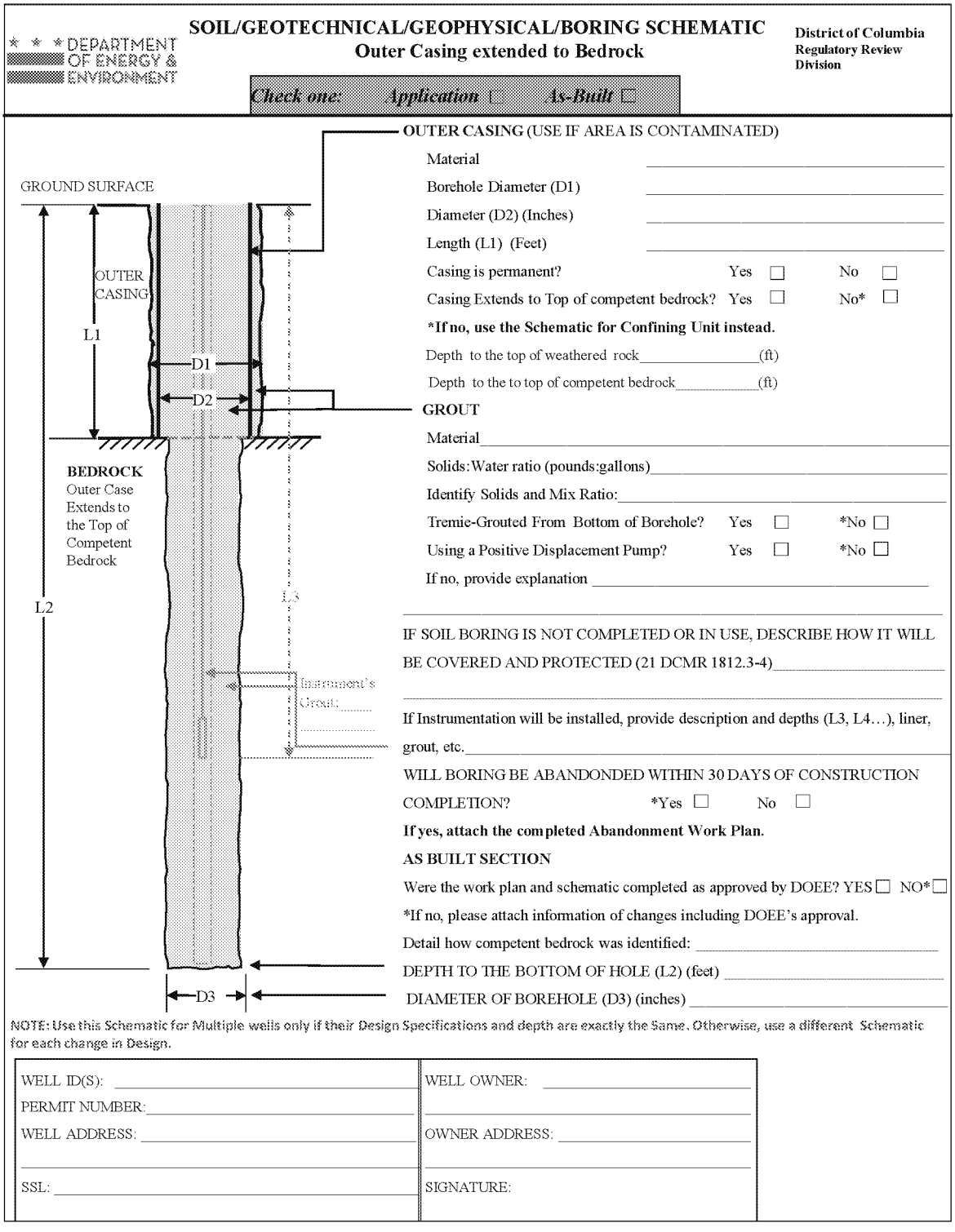


Figure 15 Soil/Geotechnical/Geophysical/Boring Schematic with Outer Casing extended to Bedrock

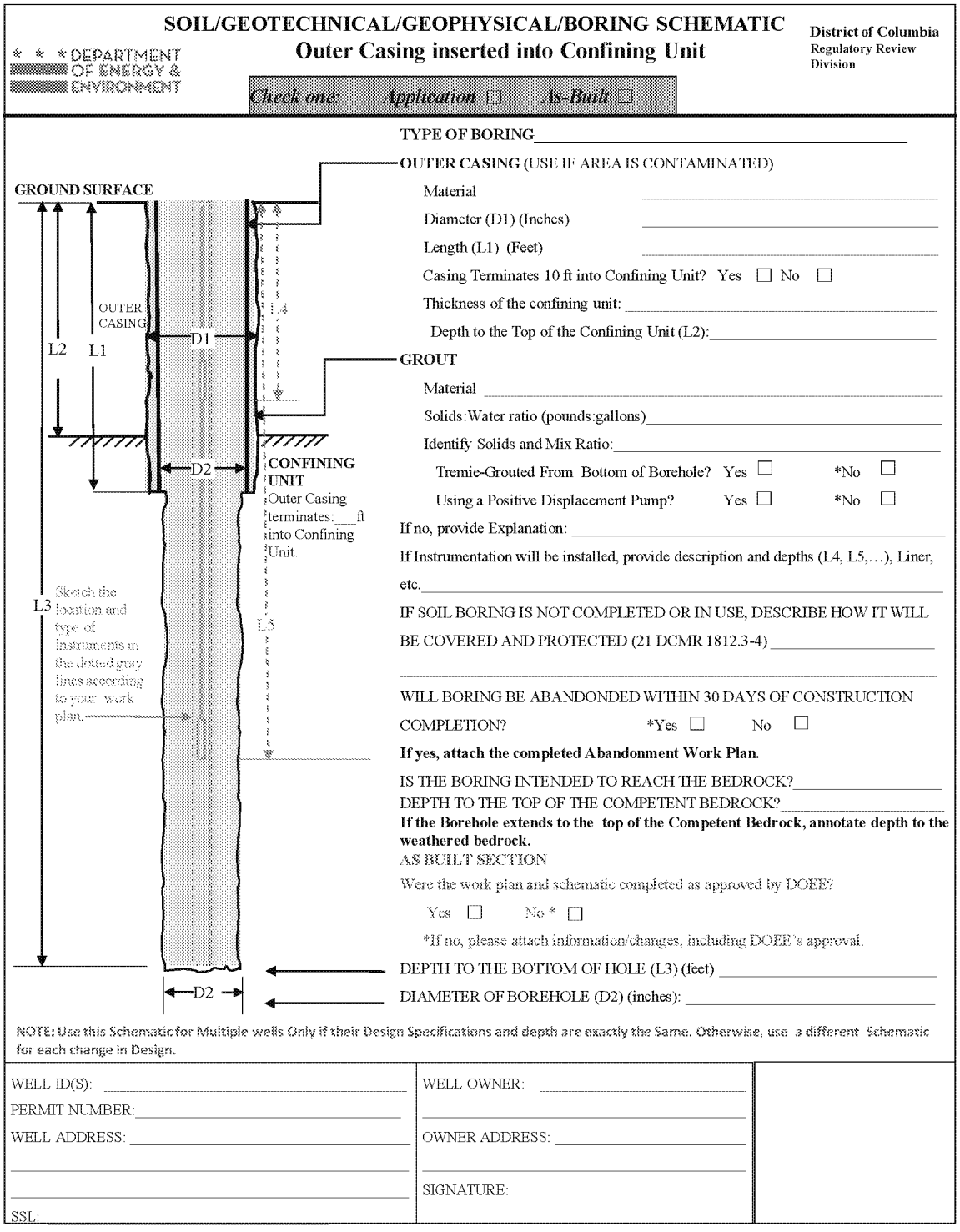


Figure 16 Soil/Geotechnical/Geophysical/Boring Schematic with Outer Casing inserted into Confining Unit

4.3 Well Construction Completion Report

The well applicant confirms construction of the proposed well and must include deviations from the work plan approved by DOEE using the Well Construction Completion Report. An explanation of deviations from the approved plan must be accompanied with written DOEE authorization. An as-built schematic must be completed at this stage (see Section 4.3.4 Construction).

4.4 Well Maintenance, Use, and Rehabilitation

The cost of maintenance and abandonment should be considered in the work plan. The well owner is responsible for ensuring that instrumentation installed on a boring is suitable for its intended use.

Preventative maintenance should include a plan with regularly scheduled visual inspections of the well and installed devices. During the inspection, the surrounding area should be checked for evidence of any activities or occurrences that could negatively impact the well, such as storage of construction materials, use of heavy equipment that may accidentally hit the well, water ponding near a flush-mounted well, and dumping. Where these conditions are noted, the well owner should take preventative measures to ensure continued protection of the well.

If well maintenance requires the use of chemical substances, replacement of instruments with different technical specifications, pipes, or other parts of the well, the owner must submit Well Maintenance information and a Work Plan to conduct such activities.

A Well Construction Permit is required to deepen or make other dimensional changes to the well, install new components or reconfigure the components inside the well, or to change or replace the upper terminus. Simple physical maintenance to the upper terminus of a well, such as the replacement of dataloggers, bolts, manhole covers, gasket seals, well caps, and well pad repairs are considered preventive maintenance and do not require a new Well Construction Permit.

The well owner must submit a report to DOEE detailing the work that was performed with supporting documentation within 60 calendar days of work completion.

Use

Borings can be used for adittional purposes of investigation (i.e. for geophysical methods). This adittional intended use for any boring, should be reported at the moment of applying for the permit.

Rehabilitation

Borings are unable to be rehabilitated due to their methods of construction. A new boring must be drilled.

4.5 Well Abandonment Process

4.5.1 Application for the Well Abandonment Work Plan

A Well Abandonment Work Plan must be submitted to DOEE 30 days before well abandonment, and abandonment of the well must be completed within 60 days of DOEE's plan approval. The

Well Abandonment Work Plan must include aldetails required for well abandonment by the District..

To abandon a well located on private property, the well owner will apply through the DCRA Online Permiting System. To abandon a boring/well installed in public space, the well owner will apply through dTOPS online permitting system.

A new well permit will be given for the Well Abandonment Work Plan, yet, the original Well Construction Permit Number needs to be reported upon application for the Well Abandonment Work Plan.

All the wells that were reported completed under the construction permit number have to be accounted for in the Abandonment Work Plan in order to get DOEE approval.

4.5.2 Procedures

The borehole must be grouted according to procedures listed in Chapter 13.5, and the upper five (5) feet of borehole restored with suitable materials to create a cover similar to that of the surrounding area, such as concrete, asphalt, native soils, or a combination of these materials.

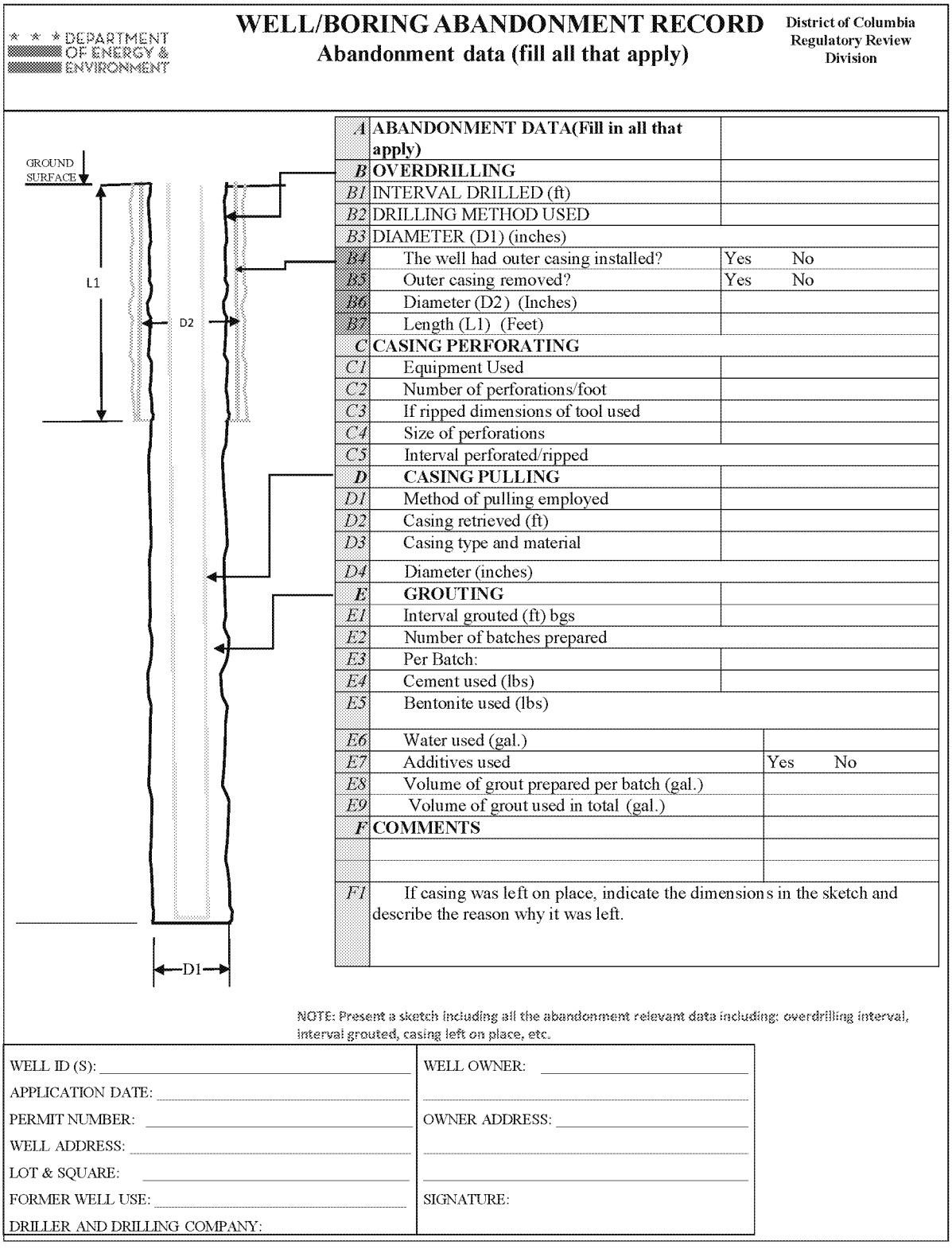
Alternative Abandonment Methods

Submit an alternate abandonment procedure to DOEE for approval. In any method selected by the applicant, DOEE expects the abandoned boring/well will be filled and sealed in an effective and permanent manner that prevents vertical fluid migration within the well or the annulus surrounding the well casing.

Alternative abandonment procedures such as abandoning in place should be a last resort and limited to wells with access problems. Examples include an instrument/boringdiscovered beneath a load bearing building structure where removal of the structure is required to remove the well; a well in the middle of utilities that must not be removed or damaged such as WMATA tunnels, DC Water Long Term Control Plan (LTCP) tunnels, natural gas lines, or utilities placed after the well was installed. DOEE will not approve alternative abandonment procedures for wells due to difficult, inconvenient, or more expensive site conditions such as wells near trees or in busy traffic areas that require lane closures.

4.5.3 Well Abandonment Report

To complete the Well Abandonment process, the well owner must submit a Well Abandonment Report to DOEE within 60 days of completing the well abandonment work, that includes completing all the questions regarding the construction procedure followed and the deviations of the DOEE's approved work plan. Uploading the Well/Boring Abandonment Record sketch from Figure 17 will follow. Photographs of the entire well abandonment work will be uploaded at that time.



DEPARTMENT OF ENERGY & ENVIRONMENT

WELL/BORING ABANDONMENT RECORD

Abandonment data (fill all that apply)

District of Columbia
Regulatory Review
Division

A	**ABANDONMENT DATA(Fill in all that apply)**		
B	**OVERDRILLING**		
B1	INTERVAL DRILLED (ft)		
B2	DRILLING METHOD USED		
B3	DIAMETER (D1) (inches)		
B4	The well had outer casing installed?	Yes	No
B5	Outer casing removed?	Yes	No
B6	Diameter (D2) (Inches)		
B7	Length (L1) (Feet)		
C	**CASING PERFORATING**		
C1	Equipment Used		
C2	Number of perforations/foot		
C3	If ripped dimensions of tool used		
C4	Size of perforations		
C5	Interval perforated/ripped		
D	**CASING PULLING**		
D1	Method of pulling employed		
D2	Casing retrieved (ft)		
D3	Casing type and material		
D4	Diameter (inches)		
E	**GROUTING**		
E1	Interval grouted (ft) bgs		
E2	Number of batches prepared		
E3	Per Batch:		
E4	Cement used (lbs)		
E5	Bentonite used (lbs)		
E6	Water used (gal.)		
E7	Additives used	Yes	No
E8	Volume of grout prepared per batch (gal.)		
E9	Volume of grout used in total (gal.)		
F	**COMMENTS**		
F1	If casing was left on place, indicate the dimensions in the sketch and describe the reason why it was left.		

NOTE: Present a sketch including all the abandonment relevant data including: overdrilling interval, interval grouted, casing left on place, etc.

WELL ID (S):	WELL OWNER:
APPLICATION DATE:	
PERMIT NUMBER:	OWNER ADDRESS:
WELL ADDRESS:	
LOT & SQUARE:	
FORMER WELL USE:	SIGNATURE:
DRILLER AND DRILLING COMPANY:	

Figure 17 Well/Boring Abandonment Record sketch

If more than one boring/well was abandoned, the applicant will be asked to provide a boring matrix/schedule accounting for all wells and borings installed under the same Well permit number regardless of whether or not they are abandoned or still in use when submitting Abandonment information. The matrix/schedule should provide the following details:

- Well Identification Number
- Date of completed abandonment
- Type of well
- Borehole depth below ground surface
- Borehole diameter
- Screened interval, if applicable
- Geologic formation or aquifer the well is/was screened in (if known)
- Well location coordinates using Maryland State Plane Coordinate System or Latitude and Longitude
- Well elevation using NAV83.
- A site map drawn to scale with a north arrow, property lines, building footprints, the nearest street intersection, and the locations of all borings or wells regardless of whether or not they are abandoned or still in use
- A scaled site map with scale bar
- A north arrow
- Property lines showing public space
- Building footprints
- The nearest street intersection
- Photographs showing the entire abandonment procedure (they have to show at least a picture of the boring/well before the abandonment, the equipment at the moment of the abandonment procedure and the photograph of the site after the boring/well abandonment.
- All the boring logs generated under the well permit if the were not submitted at the completion report stage.
- Any additional comments including deviations of the Well Abandonment Work Plan Approved.

4.6 Well Close-Out

Once DOEE approves the Well Abandonment Report and if all the stages were completed according to the well regulations, the well owner will receive an email confirming the well/boring close-out.

4.7 General Specifications

For general specifications related to contaminated sites, grouting and sealing, and derived material management and decontamination refer to Chapter 13.

Chapter 5 Monitoring Well, Observation Well, and Piezometer Requirements

5.1 Definition and Purpose

The objective of monitoring wells, observation wells, and piezometers is to achieve one or more of the following objectives:

- Provide access to the groundwater system for collection of the appropriate water samples;
- Allow the measurement of the water table, hydraulic head, or pore pressure at a specific location in the groundwater flow system; or
- Provide access for conducting field tests or collecting information necessary to characterize aquifer materials and their hydraulic properties.

Monitoring Well – A well installed for the sole purpose of assessing subsurface conditions and collecting groundwater samples.

Observation Well – A well that is used for the sole purpose of determining groundwater levels.

Piezometer – A non-pumping, non-potable well used for measuring groundwater levels, potentiometric surface, or pore pressure.

The following figures provide examples of monitoring wells (Figures ##–##), observation wells (Figures ##–##), and piezometers (Figures ##–##).

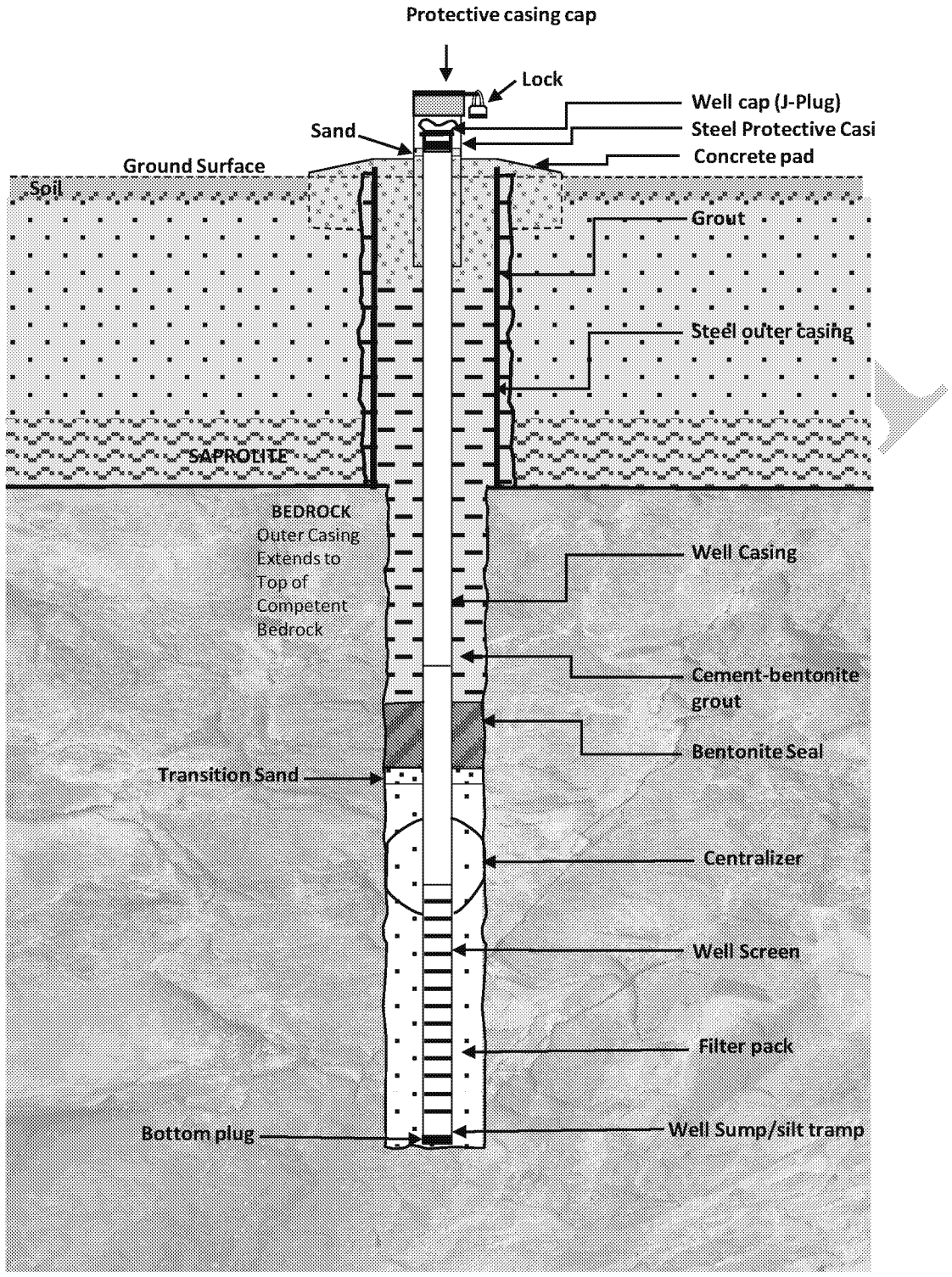


Figure 18 Example of a monitoring well installed in bedrock using a stick-up upper terminus.

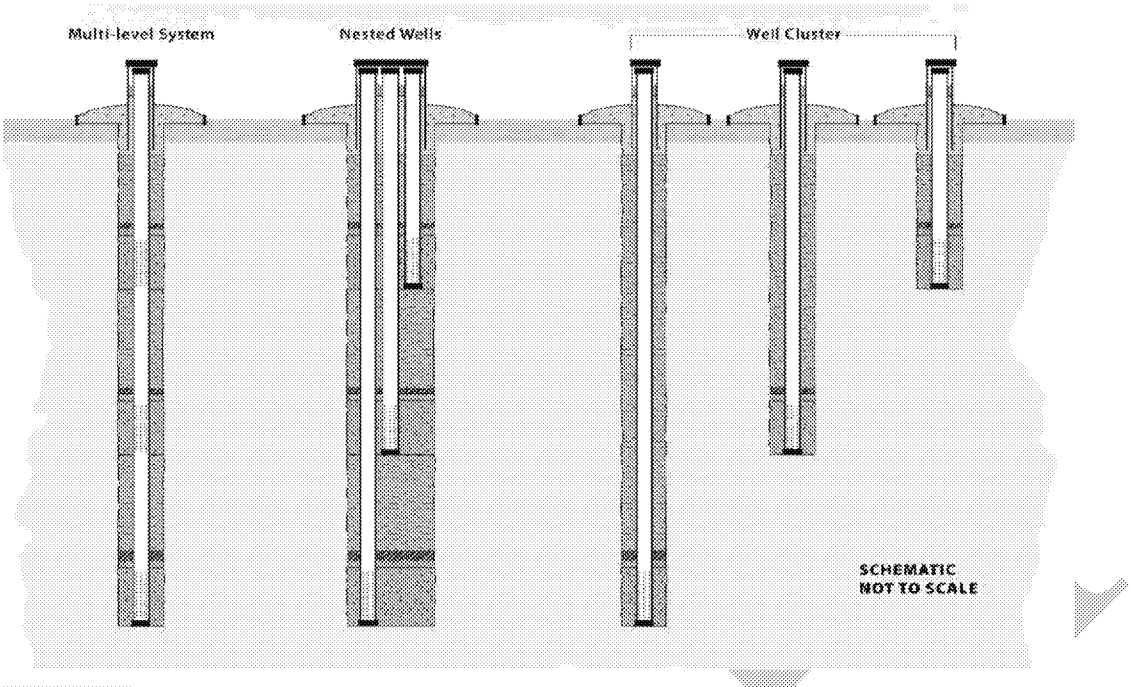
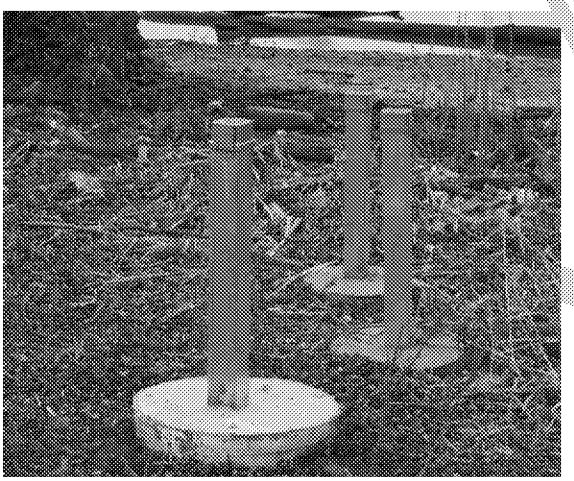
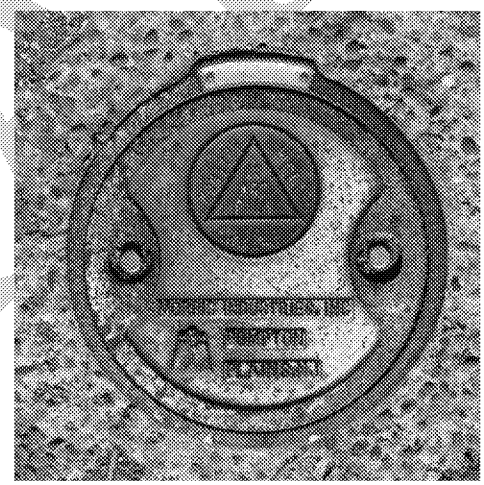


Figure 18 Types of monitoring wells (CalEPA, 2014).



Source: DOEE



Source: Steven Pavlov, 2011

Figure 19 Examples of well ground surface completions: stick up well (left) and flush mount well (right).

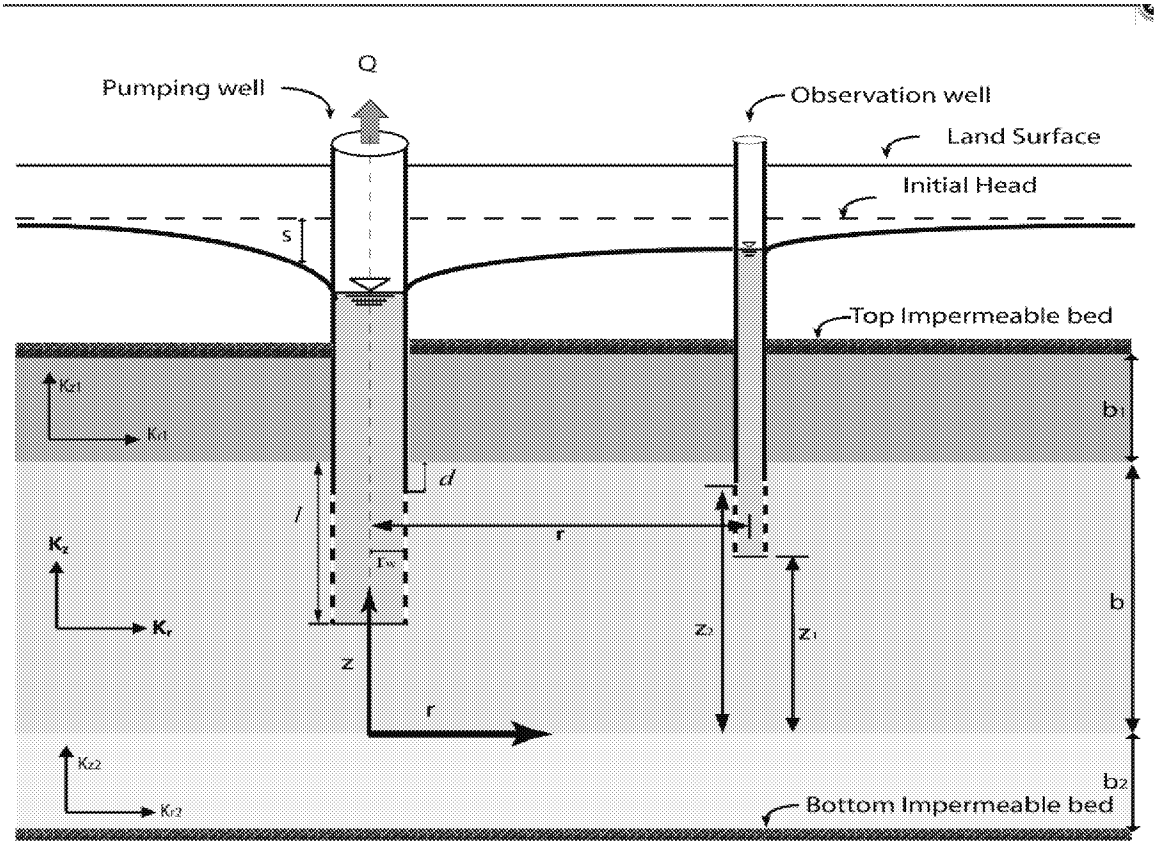
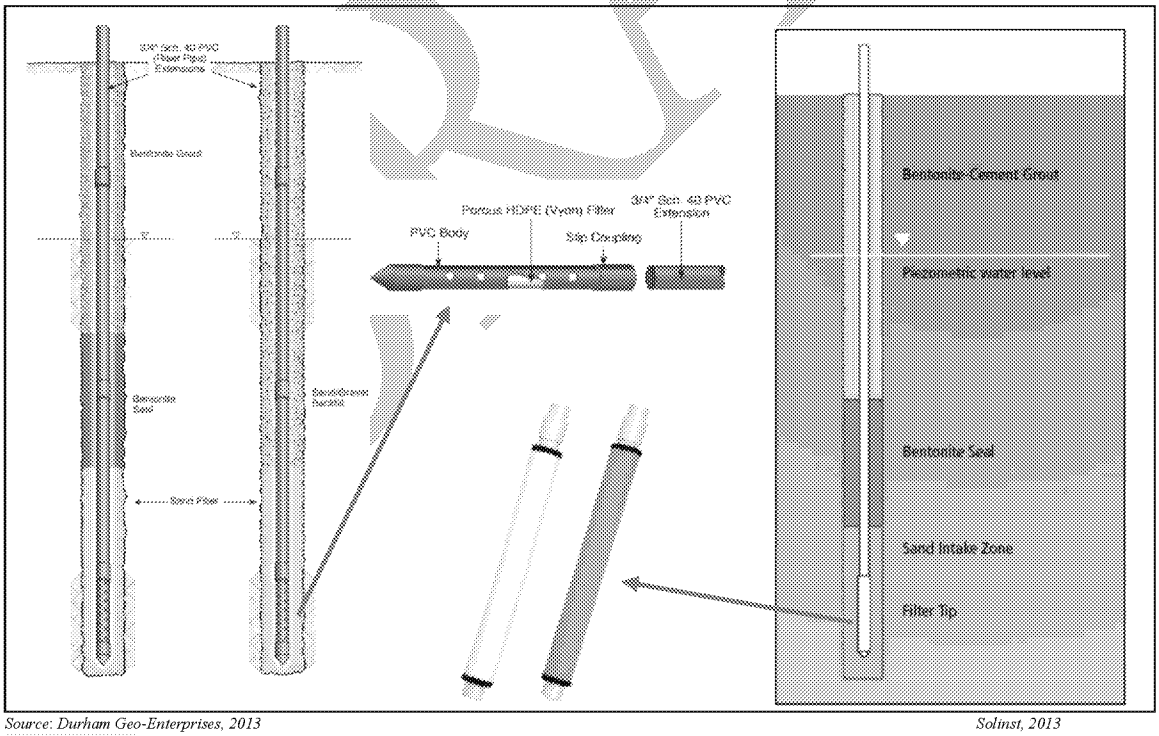


Figure 20 Typical use of an observation well (LANS, 2010)



Source: Durham Geo-Enterprises, 2013 *Solinst, 2013*

Figure 21 These are examples of typical piezometers

5.2 Well Construction Process

5.2.1 Applicability Standards

Any well must be constructed in accordance with a submitted Well Construction Work Plan. The applicant must provide two (2) full business days' notice to DOEE prior to commencing well construction activities and obtain public utility clearance of underground facilities with non-utility operators.

DOEE approval may be subject to additional conditions if the use of an outer-casing during the construction of a well is required. The same applies for grouting of the wells.

Lithological and geophysical data or additional analyses may be required to determine District water resources impact.

To comply with the Well Regulationsa well owner must ensure that, where applicable, the construction, maintenance and abandonment of the well is conducted in accordance with §1809 through §1831.

Applicants should use the DOEE Well Database to ensure compliance with the standards.

5.2.2 Drilling

All well activities requiring the use of a drilling rig (drilling, construction, maintenance and abandonment), require the supervision of a licensed well driller. The District has not implemented a driller certification program; a driller license from any state is acceptable. The driller approved at the Well Cosntruction work plan has to be maintained to perform the work up to completion unless, prior notification of driller's change is submitted to DOEE and the licenses of the new driller are submitted along with the notice. An amendment to the well permit will be made after DOEE's approval for the new driller to be allowed to perform the job.

Acceptable Drilling Methods

The well permit applicant must provide a complete Well Construction Work Plan that includes an appropriate drilling method for site-specific conditions. These include RECs, the suspected contamination depth to groundwater, perched water zones, and soil cohesiveness.

DOEE reserves the right to make determinations regarding the acceptable drilling methods.

The well owner must install a temporary or permanent outer casing during well construction to prevent aquifer cross-contamination at a contaminated site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, the well owner must install a temporary outer casing when the drilling method (e.g., direct-mud rotary drilling) does not include a dual casing and drilling fluids are used to create the borehole. Use of a temporary or permanent outer casing in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Appendix B contains a decision tree for well construction at uncontaminated or contaminated fill/alluvium and at well sites in the Potomac Group. Use of a temporary or permanent outer casing in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Contaminated deep aquifers (see Chaper 3 for a detailed geologic explanation) under confining pressure (resulting in upward vertical gradients) that are penetrated during drilling require adherence to specific protocols. A permanent outer casing should terminate in a confining unit above the contaminated zone. This casing must be grouted according to the grouting requirements indicated in the District Well Regulations and be allowed to set prior to advancing the borehole into the contaminated zone. The outer casing will maximize chances of controlling artesian flow, contain the flow within the casing if drilling fluid weight is insufficient to overcome the pressure of the flow, and stabilize the soil around the wellhead. Management of contaminated derived waste (cuttings and fluids) becomes a requirement. The use of a down-hole packer or water-tight well cap may be required if artesian flow occurs in order to minimize the volume of contaminated water discharging from the well.

The annular space between the outer casing and well casing should be grouted. Bentonite slurry grouts have little ability to resist axial forces that can displace the grout seal in artesian flow, making bentonite grouts unsuitable for high hydraulic gradient sealing locations where strength is important.

Unacceptable Drilling Methods

Drilling methods for well installation that cannot advance a temporary or permanent outer-casing during drilling, or that are subject to borehole collapse, are considered unacceptable when any of the following conditions are present:

- Sites where known contamination or RECs are present;
- Wells that penetrate perched water or the groundwater table;
- Wells with strong upward gradients (artesian flow); or
- Wells in non-cohesive soils.

Bucket auger and well jetting are examples of drilling methods not recommended for these conditions (EPA, 1993). Neither method can advance a casing, nor do they meet the regulatory requirements for proper well construction. Drilling methods that cannot adequately advance through hard materials such as gravel, rock, and tight clays should also not be used. Hollow-stem auger rigs withouth previous outercasing in the shallow aquifer and bucket augers are not suitable for drilling through Arundel Clay in the District.

Direct mud rotary drilling, while typically suitable for use in the Arundel Clay, can exacerbate the vertical movement of pollutants in the subsurface. A mud rotary drill rig needs to use casing advancement such as a drill through casing driver or dual rotary advancement as a pollution preventative measure at the contaminated site, or where a groundwater contaminant plume is known or suspected to be present.

Wells in Cohesive and Non-Cohesive Materials

A well must have a large enough diameter to allow placement of a tremie pipe and appropriate grout during the abandonment process. Well drilling methods that do not allow proper well abandonment procedures in accordance with District Well Regulations are prohibited. Borehole well collapse is not an acceptable abandonment process. Destroying wells during construction activities at the construction site where it is located is also an unacceptable abandonment method.

Use of Drilling Fluids

All drilling fluids used in the District must use only potable water to create a water-based drilling fluid. The use of additives must be approved by DOEE in the well construction permit application by demonstrating that the additive does not pose a hazard to public health, environment, and safety.

5.2.3 Well Construction

Cross Contamination Design Specifications

A well must not hydraulically connect otherwise confined aquifers thereby causing aquifer cross-contamination, or hydraulically connect portions of a single aquifer where contaminants exist in separate definable layers within the aquifer. Temporary or permanent outer casings are required during well construction to prevent aquifer cross-contamination at a contaminated site. The use of temporary or permanent outer casings is determined based upon the type and location of the contamination at a site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, a well owner is required to install a temporary outer casing when the drilling method does not include a dual casing and drilling fluids are used to create the borehole (e.g., direct mud-rotary drilling).

The geology of a site can complicate the selection of the target zones for monitoring or observation. Geological factors can produce aquifers that are anisotropic. In an anisotropic aquifer, groundwater moves faster in one direction than another and is oblique to the hydraulic gradient. Anisotropy can result from various sedimentary or structural features such as buried channels, bedding planes, folds, faults, and fractures. In the District, most groundwater flow is either through fractured rocks from the Piedmont or granular materials from sedimentary rocks belonging to the Coastal Plain. Fracture flow in Piedmont bedrock requires additional considerations compared to flow in unconsolidated materials from the Coastal Plain.

Bedrock may exhibit small effective porosities and low hydraulic conductivities that impede groundwater flow. However, its secondary porosity may allow substantial flow of groundwater through fractures, joints, cleavage planes, and foliations. These features tend to be highly directional, exhibit varying degrees of interconnection, and may produce local groundwater flow regimes that can be different from the regional trends. The sedimentary bedding planes and distribution and nature of the Coastal Plain have significant effects on groundwater flow, presenting a series of aquifers and aquitards at different depths. The recent sedimentary deposits (alluvium, artificial sill, and fluvial terraces) and the weathered bedrock (Saprolite) conform most of the District unconfined aquifer, including perched groundwater conditions in the Coastal Plain area of the District. It is important to understand the characteristics of the District's hydrogeologic system before designing any well.

Boring Location and Relocation

Wells must be accessible for maintenance, inspection, and abandonment, and cannot be constructed within or under any building. A utility clearance study is needed to locate utility lines. Pre-existing subsurface structures (e.g., tunnels, diversion sewers, metro) must be identified.

If the well is sited within the 100 year floodplain or other flood prone area the top of the well head must be at least 24 inches above the finished grade and fully protected from surface water

intrusion. A well must be located a minimum of 25 feet of the higher watermark of any water body of the District or wetland.

A permitted well can be reolocated to avoid utility lines or other obstacles if it is moved 10 feet or less from the approved location and is on the same lot and square number. Relocation to short distances larger than 10 feet may be reconsidered upon a request demonstrating that the new location does not change the original geologic and environmental conditions of the original permit, and the wells design will remain the same. A formal request (statement letter signed by the well owner) should be submitted to DOEE with all the support information. If approved the relocation an amendment will be made to the original well permit. Otherwise, the applicant will have to reapply for a new well permit on the new location. Required well setback distances must be maintained in accordance with site-specific requirements.

Sanitary Protection

Sanitary protection measures must be installed and protective measures taken for each well and during construction to protect the well and any water-bearing formation against contaminants from any source and surface water drainage. If contaminants not addressed in the well construction permit are found during drilling the well owner must stop well construction, notify DOEE, and follow Well Regulation procedures. A well must be covered and protected from surface water drainage, vertical migration of contaminants, and other materials when not in use. All materials, including drilling fluids or muds, used in the construction of a well must be free of contaminants and adhere to District and Federal laws and regulation.

Well Casing

Well materials, fittings, and equipment must be approved by the American Society for Testing and Materials (ASTM), the American Water Works Association (AWWA), or the National Science Foundation (NSF). Additional details can be found in the District Well Regulations.

Well Screens

Well screens should not extend across more than one aquifer, and must be installed in a way that prevents the cross-contamination of aquifers. Material design and strength must be appropriate for the encountered aquifer materials.

Filter Pack in Well

The well filter must be clean and free of toxic materials and substances, and the design must be appropriate for the encountered aquifer materials. The Well Design and Construction Plan must comply with the restrictions and exemptions detailed in the District Well Regulations.

Well Grouting

A request may be made to DOEE in to deviate from the grouting standards of the District Well Regulations provided the deviation does not result in a less protective standard. DOEE may impose additional requirements pertaining to the grouting of a well in the well construction permit to ensure the protection of public health and safety and the environment.

A sodium-based bentonite grout should be fully hydrated in accordance with the manufacturer's specifications. Over hydration can lead to slumping and cracking when the grout begins to dry above the saturated zone. The choice between a pure sodium-based bentonite grout and a

sodium-based bentonite-cement mixture that is predominantly comprised of cement is dependent on the intended use of the grout and site conditions.

A pure bentonite slurry grout is suitable below the saturated zone but will tend to dry and crack in the unsaturated zone. This material typically should be used for a well screen in the saturated zone; when extending up through the unsaturated zone a bentonite-cement grout should be used accordingly.

Well Development

DOEE expects that a properly designed, constructed, and developed well in a non-fill area will be able to easily attain a turbidity level of 10 Nephelometric Turbidity Units (NTUs). As in-situ fine-grained sediments in fill areas may present development challenges, the regulations allow well development to be completed if all field parameter values stabilize and turbidity values do not exceed 20 NTUs. However, for a monitoring well, the turbidity level must stabilize at 5 NTUs, and the pH, specific conductivity, temperature, and turbidity of water recovered from the well must be determined to be within a ten percent (10%) range and considered at equilibrium.

Well Caps & Upper Terminus of Well

The upper terminus of a well must meet the requirements of the regulations unless otherwise approved in writing by DOEE. The most common upper terminus of wells, flush-mount and stick-up, are detailed in the DOEE Schematics presented in 5.4.10.

Well Labeling

A well registration number issued by DOEE must be attached or labeled at a visible location to the terminal surface of a well. A well registration label is not be required for a monitoring well, observation well, or piezometer provided the well is abandoned within 30 days of well completion in accordance with the District Well Regulations.

5.2.4 Schematics

DOEE developed four well schematics based on regulations for monitoring wells, observation wells, and piezometers to facilitate construction permit applications. The use of only one schematic for multiple wells or piezometers is allowed if the design specifications and depths are exactly the same for each well or piezometer to be drilled or installed. Otherwise, a different schematic must be used for each design. If instruments, permanent purge systems, or other components will be installed in the wells or piezometers, the District requires that the corresponding schematic fields contain the type, depths, and other relevant specifications.

In situations where the well is located in western parts of DC where bedrock is near or at the surface, or in areas where bedrock is expected to be reached and the outercasing will terminate on above it, the schematics with Outer Casing Extended to Bedrock (Figures 24 and 25) should be used.

If the well will reach bedrock but the outer casing is inserted and terminates into the confining unit of the granular formation above it, the schematics with Outer Casing Inserted into Confining Unit (Figures 22 and 23) should be used. The depth to weathered bedrock and the top of bedrock must be annotated. These schematics must also be used in situations where the boring will reach the main granular DC Aquifer (i.e. Potomac Group, or any similar aquifer unit above the bedrock: see Chapter 3). These schematics are particularly important when the boring will be

drilled in a contaminated area. District Well Regulations specify an outer casing be inserted ten feet into the confining layer if the thickness of the confining layer allows it. If the thickness of the confining layer is thinner than ten feet, the schematic must report the expected thickness of the confining unit, and the design must specify the thickness to be penetrated by the outercasing to avoid connecting the shallow, polluted aquifer with the underlying granular unit or aquifer.

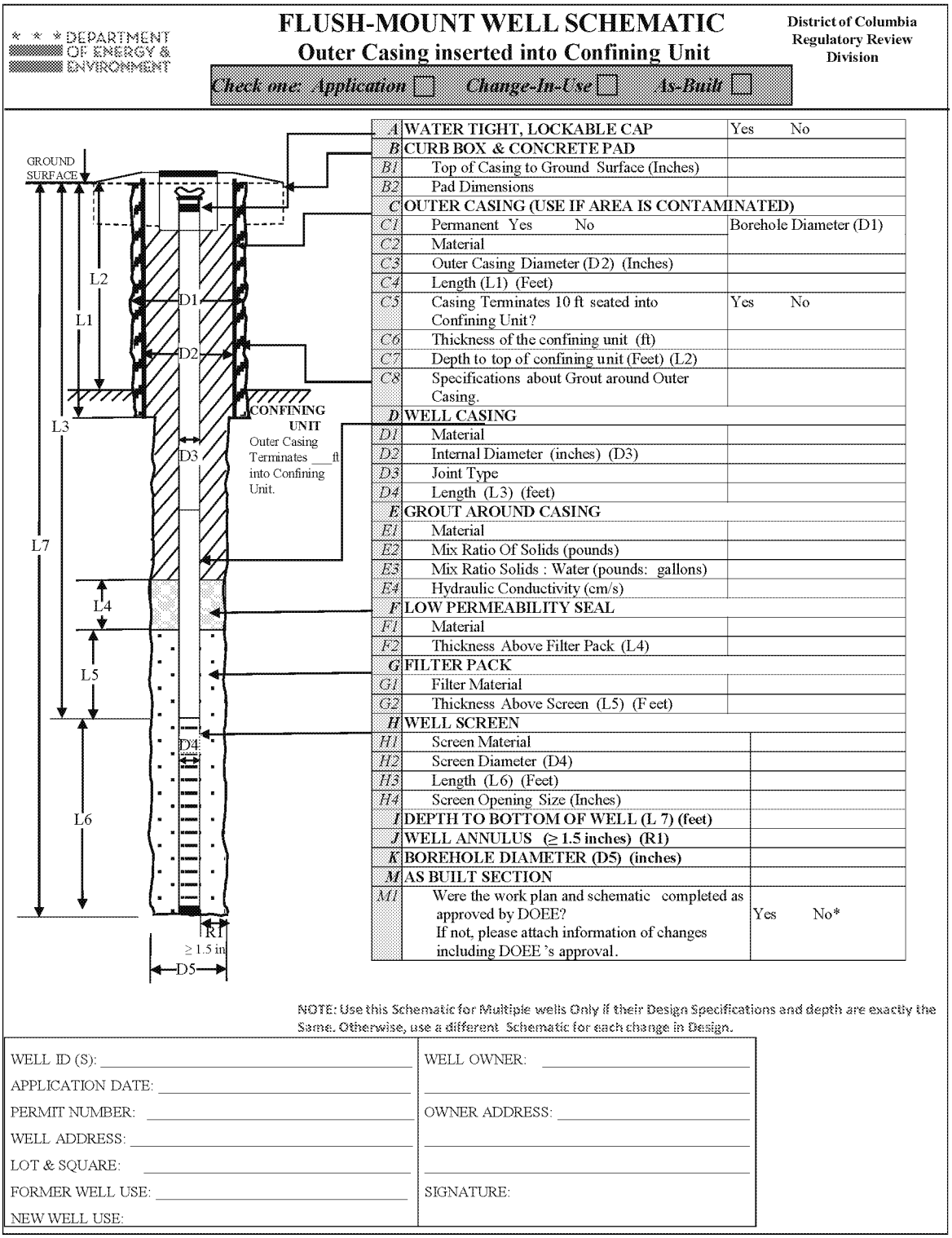
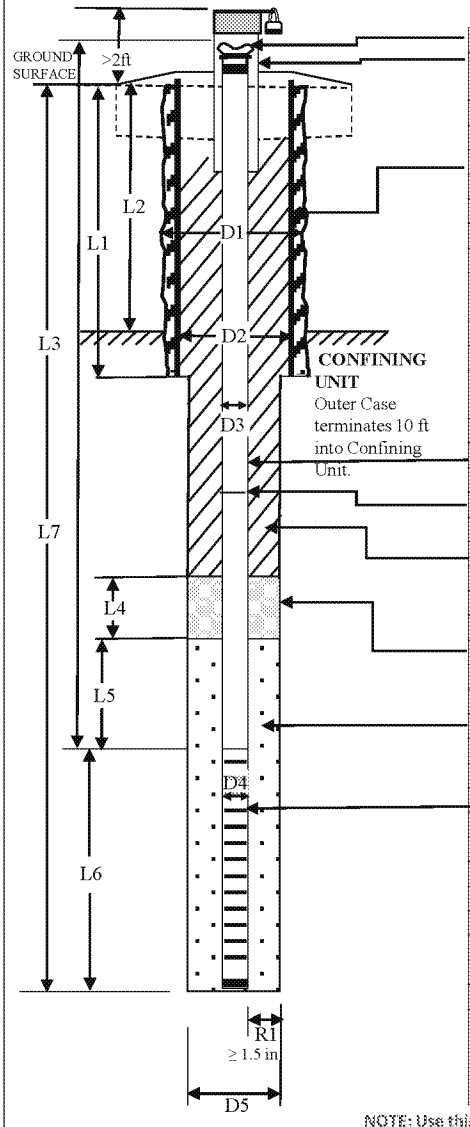


Figure 22 Flush-mount well schematic with outer casing inserted into confining unit.



* * * DEPARTMENT OF ENERGY & ENVIRONMENT

STICK-UP WELL SCHEMATIC

Outer Casing inserted into Confining Unit

District of Columbia
Regulatory Review Division

Check one: *Application* ☐ *Change-In-Use* ☐ *As-Built* ☐

A	**WATER TIGHT, CAP**	Yes No	
B	**LOCKING PROTECTIVE CASING WITH COVER (at least 2 feet high) & CONCRETE PAD**		
B1	Top of Casing to Ground Surface (feet)		
B2	Pad Dimensions		
C	**OUTER CASING (USE IF AREA IS CONTAMINATED)**		
C1	Permanent Yes No	Borehole Diameter (D1)	
C2	Material		
C3	Diameter (D2) (Inches)		
C4	Length (L1) (Feet)		
C5	Casing Terminates 10 ft seated into confining Unit?	Yes No*	
C6	* If no, Thickness of the Confining Unit		
C7	Depth to top of Confining Unit (Feet) (L2)		
C8	Specifications of grout around Outer Casing, if different from grout around casing.		
D	**WELL CASING**		
D1	Material		
D2	Internal Diameter (inches) (D3)		
D3	Joint Type		
D4	Length (L3) (feet)		
E	**GROUT AROUND CASING**		
E1	Material		
E2	Mix Ratio Solids : Water (pounds: gallons)		
E3	Hydraulic Conductivity (cm/s)		
F	**LOW PERMEABILITY SEAL**		
F1	Material		
F2	Thickness above Filter pack (L4)		
G	**FILTER PACK**		
G1	Filter Material		
G2	Thickness Above Screen (L5) (feet)		
H	**WELL SCREEN**		
H1	Screen Material		
H2	Internal Diameter (Inches) (D4)		
H3	Length (L6) (Feet)		
H4	Screen Size Opening (Inches)		
I	**DEPTH TO BOTTOM OF WELL (L7) (ft)**		
J	**WELL ANNULUS (≥ 1.5 inches) (R1)**		
K	**DIAMETER OF BOREHOLE (D5) (inches)**		
L	**AS BUILT SECTION**		
L1	Was the work plan and schematic completed as approved by DOEE? If not, please attach information of changes including DOEE's approval.	Yes No*	

NOTE: Use this Schematic for Multiple wells Only if their Design Specifications and depth are exactly the Same. Otherwise, use a different Schematic for each change in Design.

WELL ID (S):	WELL OWNER:
APPLICATION DATE:	
PERMIT NUMBER:	OWNER ADDRESS:
WELL ADDRESS:	
LOT & SQUARE:	
FORMER WELL USE:	SIGNATURE:
NEW WELL USE:	

Figure 23 Stick-up well schematic with outer casing inserted into confining unit.

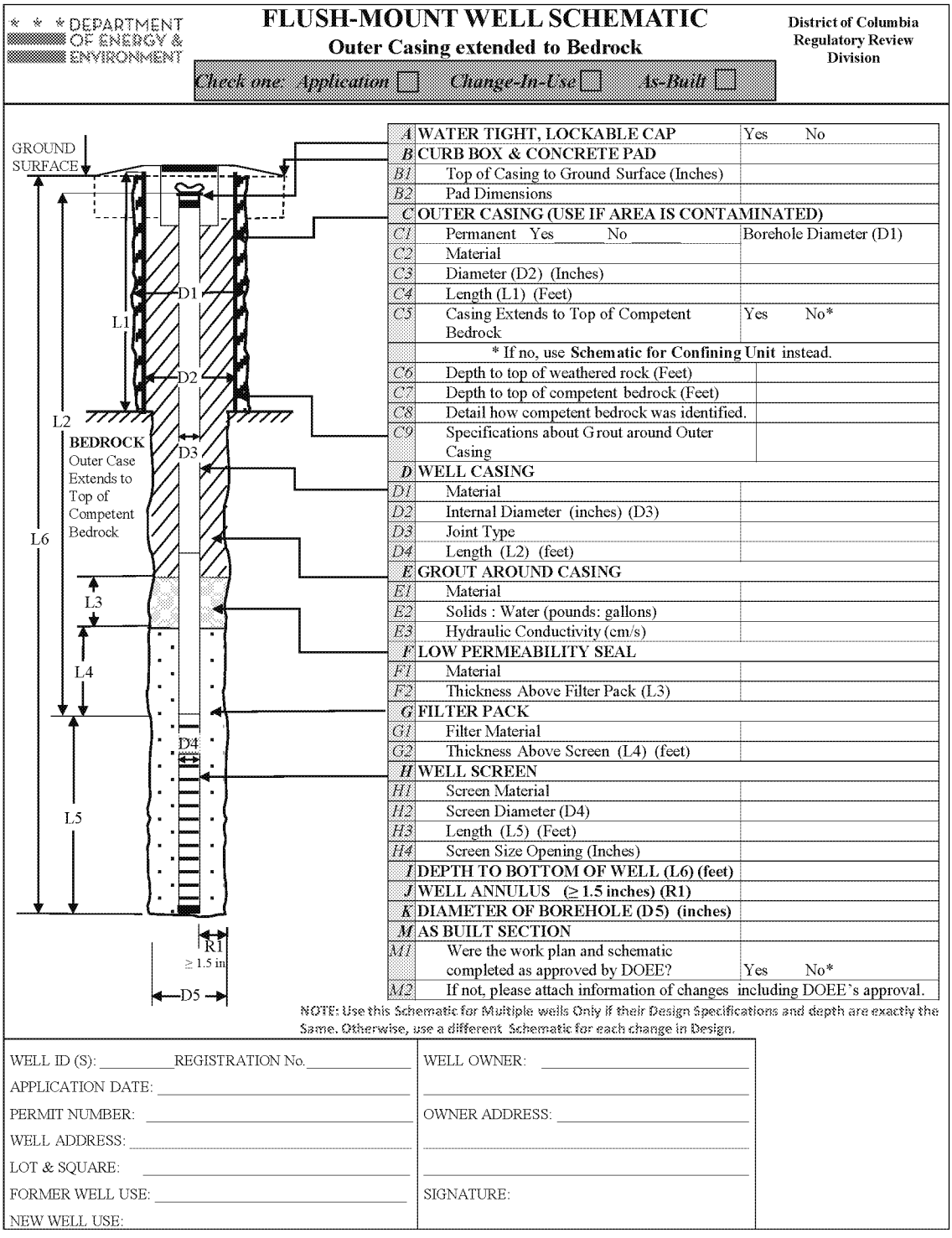


Figure 24 Flush mount well schematic with outer casing extended to top bedrock.

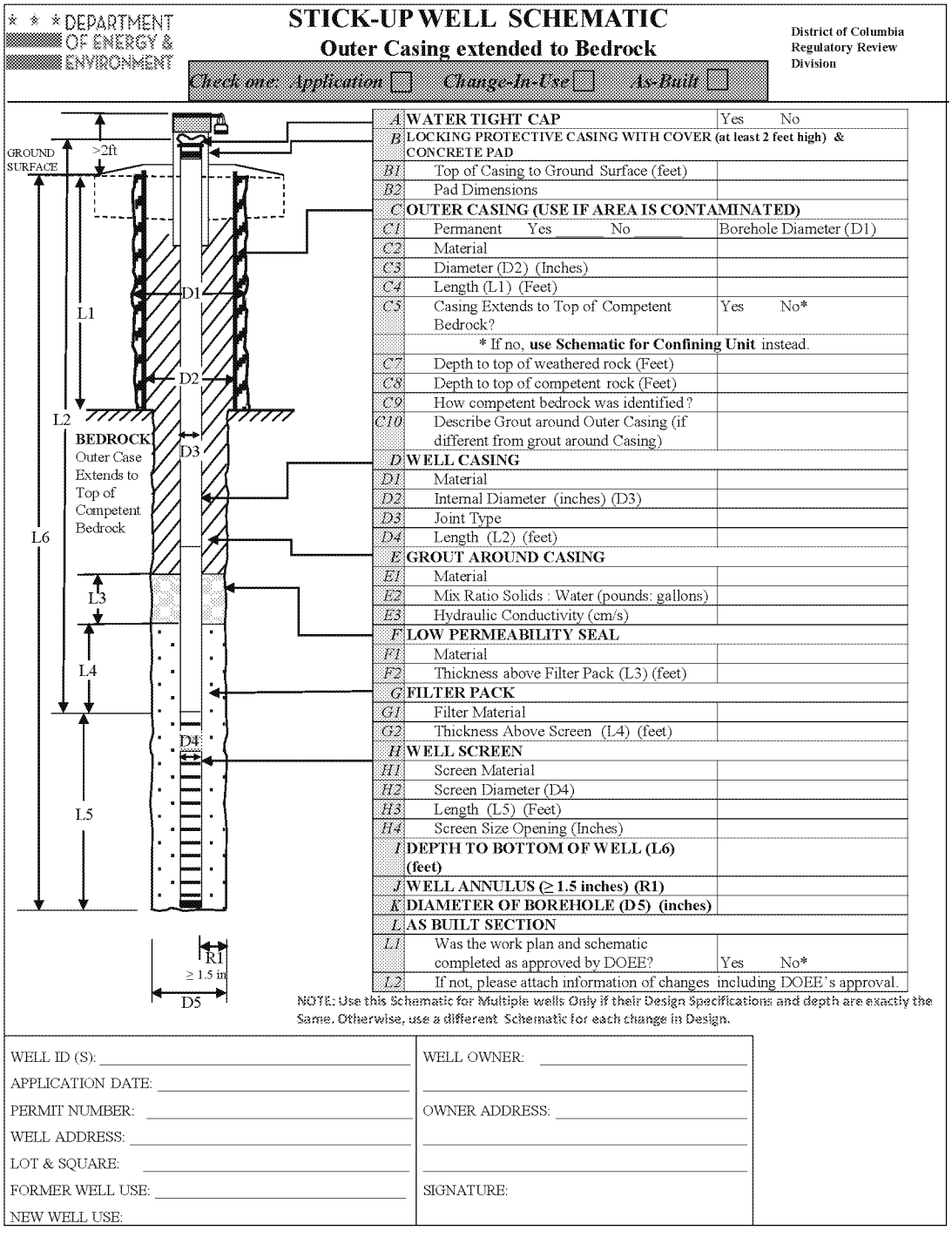


Figure 25 Stick-up well schematic with outer casing extended to top bedrock.

5.3 Well Construction Completion Report

The well applicant confirms construction of the proposed well and must include deviations from the work plan approved by DOEE using the Well Construction Completion Report. An explanation of deviations from the approved plan must be accompanied with written DOEE authorization. An as-built schematic must be completed at this stage (see Section 5.3.4 Construction).

5.4 Well Use and Maintenance Requirements

Well maintenance is mandatory, and is performed to avoid impairment of the groundwater, prevent corrosion and safety hazards, address limitations in well use due to clogging of the well screen or water intake, and lower turbidity levels.

Well maintenance must be performed using physical methods such as scrubbing and well redevelopment prior to the use of chemical treatment. Mild chemical treatment with minimal impact to groundwater and well structural integrity should be shown to be ineffective through application before a well owner proposes the use of harsh or strong chemicals.

A well maintenance work plan involving chemical treatment must include:

- details of the well;
- the maintenance problem and supporting documentation such as changes in water level data, water yield data, water chemistry data, color, taste, or odor;
- downhole video camera inspection findings;
- photographs;
- details and results of physical methods used to clean the well screen and any equipment such as pumps and lines;
- the proposed action including the products to be used, the treatment process and endpoints, duration of treatment, the expected impact on the waters of the District during treatment, and how the impact will be minimized and reversed;
- safety data sheets (SDS) and manufacturer's specifications for proposed chemical products;
- sampling protocols during treatment, monitoring locations, sampling frequency, analytes to be sampled, and EPA-approved laboratory methods with appropriate detection and reporting limits that will be used;
- data quality assurance and quality controls;
- laboratory National Environmental Laboratory Accreditation Conference (NELAC) certification;
- well driller's license and business license to operate in the District;
- copy of the current well permit and registration;
- information about solid and effluent disposal including the effluent discharge location and treatment prior to discharge, if applicable;

- a map or figure showing the location of the well, site features, property lines, nearest street intersection, scale bar and north arrow;
- proposed treatment schedule; and
- any other details.

If an owner uses a monitoring or observation well to characterize the groundwater for discharge permit or approval in order to discharge groundwater through the District's municipal separate stormwater sewer system (MS4), they must comply with well development, purging, and data collection requirements of the District's Water Quality Monitoring Regulations in Chapter 19 of Title 21 DCMR if the results will be submitted to DOEE for regulatory and decision-making purposes.

5.5 Well Abandonment Process

5.5.1 Application for the Well Abandonment Work Plan

A Well Abandonment Work Plan must be submitted to DOEE 30 days before well abandonment, and abandonment of the well must be completed within 60 days of DOEE's plan approval. The Well Abandonment Work Plan must include all details required for well abandonment by the District.

To abandon a well located on private property, the well owner will apply through the DCRA Online Permiting System. To abandon a well installed in a public space, the well owner will apply through dTOPS online permitting system.

A new well permit will be given for the Well Abandonment Work Plan, yet, the original Well Construction Permit Number needs to be reported upon application for the Well Abandonment Work Plan.

All the wells that were reported completed under the construction permit number have to be accounted for in the Abandonment Work Plan in order to get DOEE approval.

Alternative Abandonment Methods

Alternative abandonment procedures such as abandoning in place should be a last resort and limited to wells with access problems. Examples include an instrument/boringdiscovered beneath a load bearing building structure where removal of the structure is required to remove the well; a well in the middle of utilities that must not be removed or damaged such as WMATA tunnels, DC Water Long Term Control Plan (LTCP) tunnels, natural gas lines, or utilities placed after the well was installed. DOEE will not approve alternative abandonment procedures for wells due to difficult, inconvenient, or more expensive site conditions such as wells near trees or in busy traffic areas that require lane closures.

The Well Abandonment Work Plan form (appendix A) was designed to include all the details and information required for well abandonment including reason(s) for abandonment; the depth and diameter of the well; the well abandonment details, including the procedures and materials used; the details describing how any waste materials from the abandoned well or derived from well abandonment will be collected and disposed; the details regarding the well's condition and if obstructions exist that may potentially interfere with the abandonment processes; the well driller's name, address, telephone number, electronic mailing address, a copy of the pertinent

Department of Consumer and Regulatory Affairs licenses, and a copy of the well driller's license; a statement signed by the well owner that the well will be abandoned in accordance with the well abandonment requirements of the well regulations; and any other relevant details.

5.5.2 Procedures

The well must be grouted according to procedures listed in Chapter 13.5, and the upper five (5) feet of borehole restored with suitable materials to create a cover similar to that of the surrounding area, such as concrete, asphalt, native soils, or a combination of these materials.

In any method selected by the applicant, DOEE expects that the abandoned well will be filled and sealed in an effective and permanent manner that prevents vertical fluid migration within the well or the annulus surrounding the well casing.

Acceptable Abandonment Procedures

Rip or perforate the well casing below ground surface - Rip or perforate the casing followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting of the well annulus or the well annulus was allowed to be backfilled with cuttings. The grout will flow through the openings or perforations to seal any porous zones along the outside of the casing. A minimum of five perforations per linear foot of casing or screen is recommended (American Society for testing Materials, Standard D 5299-99, 2012). After the rip or perforating is complete, the borehole must be grouted according to the procedures listed on chapter 13.5 and the upper five (5) feet of borehole restored with suitable materials to create a cover similar to the surrounding area such as concrete, asphalt, native soils, or a combination of these materials.

Over-drill the well casing for removal - Over-drilling is the abandonment technique used to remove an entire well, its sand or gravel pack, and the old grout column and fill. In situations where PVC screens and risers are expected to be severed and removal of all well materials is required, the over-drilling technique is required. Over-drilling is used when a riser cannot be pulled and it penetrates a confining layer. It is commonly used to remove monitoring wells.

A temporary casing may be required when conditions are present such a high concentrations of mobile contaminants in upper layers (fill, alluvium, or granular materials), depth to water is shallow or there are perched aquifer conditions, there is poor construction documentation, or construction practices were used. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling, pulling, and grouting within this casing. The casing is recovered at the end of pulling, grouting, and drilling. If the confining unit is less than five (5) feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of two (2) feet below the top of the confining layer. After the outer casing is set, the well can be removed and grouted through pulling, if possible, or removed and grouted by drilling inside the casing.

Over-drilling is recommended where casing pulling is determined to be unfeasible or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled.

As a precaution, the well column should be filled with grout before over-drilling.

Prior to over-drilling, the bottom of the well should be perforated or cut away and the casing filled with grout.

Over-drilling should advance beyond the original bore depth by a distance of half-a-foot (six inches) to ensure complete removal of the construction materials.

5.5.3 Well Abandonment Report

To complete the Well Abandonment process, the well owner must submit a Well Abandonment Report to DOEE within 60 days of completing the well abandonment work, that includes answering all the questions regarding the construction procedure followed and the deviations of the DOEE's approved work plan. Uploading the Well Abandonment Record sketch from Figure 17 will follow. Photographs of the entire well abandonment work will be uploaded at that time.

A well Abandonment Report submitted to DOEE must include the relevant DC Well Abandonment and/or DC Well Construction Completion forms. If more than one well was abandoned, the applicant will be asked to provide a well matrix/schedule accounting for all wells and borings installed under the same Well permit number regardless of whether or not they are abandoned or still in use when submitting Abandonment information. The matrix/schedule should provide the following details:

- Well Identification Number
- Date of completed abandonment
- Type of well
- Borehole depth below ground surface
- Borehole diameter
- Screened interval, if applicable
- Geologic formation or aquifer the well is/was screened in (if known)
- Well location coordinates using Maryland State Plane Coordinate System or Latitude and Longitude
- Well elevation using NAV83.
- A site map drawn to scale with a north arrow, property lines, building footprints, the nearest street intersection, and the locations of all borings or wells regardless of whether or not they are abandoned or still in use
- A scaled site map with scale bar
- A north arrow
- Property lines showing public space
- Building footprints
- The nearest street intersection
- Photographs showing the entire abandonment procedure (they have to show at least a picture of the boring/well before the abandonment, the equipment at the moment of the abandonment procedure and the photograph of the site after the boring/well abandonment.

- All the boring logs generated under the well permit if the were not submitted at the completion report stage.
- Any additional comments including deviations of the Well Abandonment Work Plan Approved.

5.6 Well Close-Out

Once DOEE approves the Well Abandonment Report and if all the stages were completed according to the regulations, the well owner will receive an email confirming the well close-out.

5.7 General Specifications

For general specifications related to contaminated sites, grouting and sealing, and derived material management and decontamination refer to Chapter 13.

Chapter 6 Closed-Loop Ground Source Heat Pump / Geothermal Well Requirements

6.1 Definition and Purpose

Closed-Loop Ground Source Heat Pump (GSHP) Well – a well in which fluid is circulated in a continuous closed-loop fluid system installed beneath the surface of the earth or in a medium where the system can obtain sufficient cooling or heat exchange, as shown in Figure 26.

Sometimes referred to as geothermal well, geo exchange, earth-coupled, or water-source heat pumps have been in use in the United States for more than 75 years.

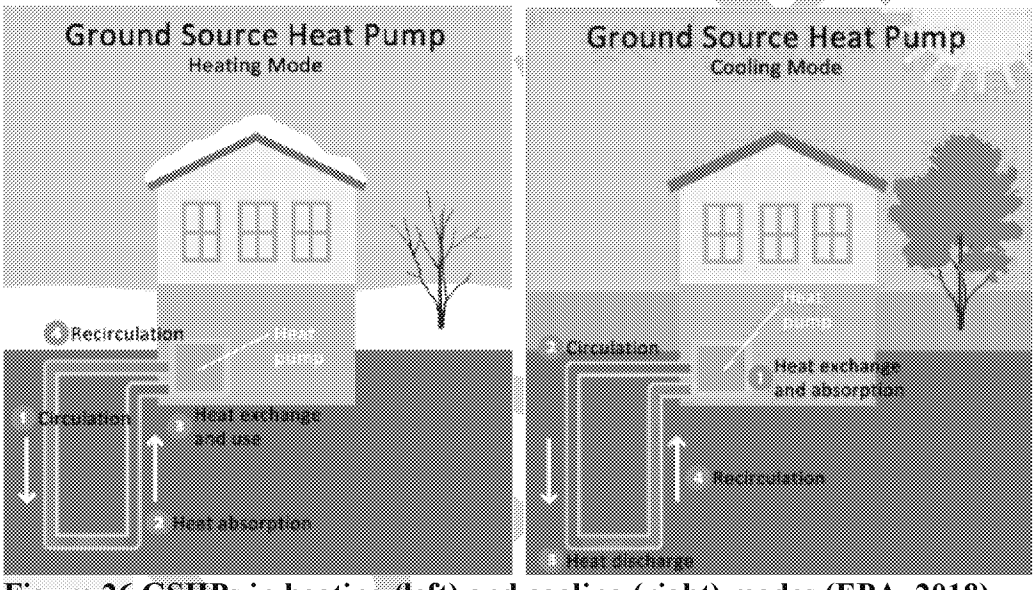


Figure 26 GSHPs in heating (left) and cooling (right) modes (EPA, 2018)

Vertical loops are usually installed in boreholes drilled into the ground. The pipes (in most cases made of plastic) that circulate the heat exchange fluid are installed to depths up to 400 feet with a horizontal spacing generally between 10 and 25 feet. The distance is selected to optimize system efficiency at the ideal long and short term ability of the ground to retain or give off heat. The heat exchange fluid is commonly antifreeze to prevent the fluid from freezing conditions and extend the operating range of the system. There are three basic types of closed -loop systems: vertical, horizontal, and pond/lake. All systems are used for both residential and commercial building applications.

Figure 26 Installation of the HDPE close-loop into a vertical boring

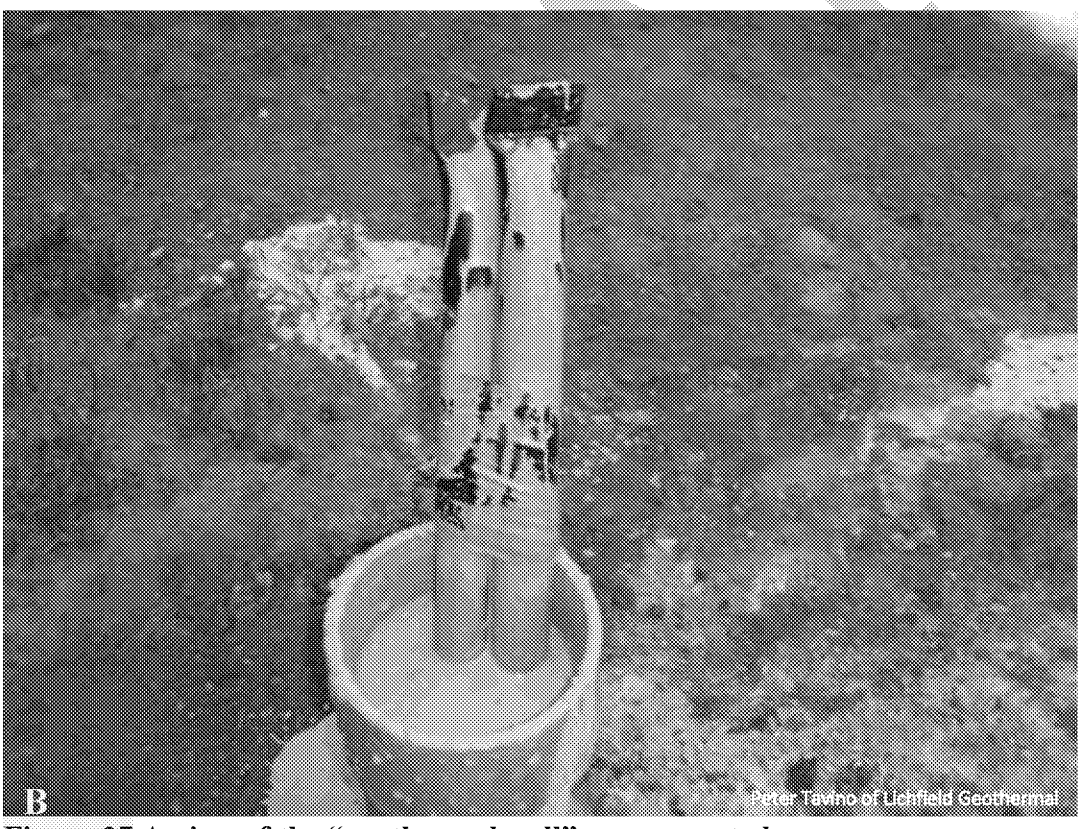


Figure 27 A view of the "geothermal well" once grouted

Environmental issues of closed-loop GSHP systems include the risk of groundwater pollution as a result of antifreeze leaks that migrate to groundwater. Improperly constructed boreholes can also potentially serve as conduits for cross contamination from the surface to an aquifer or from one potentially contaminated aquifer to another.

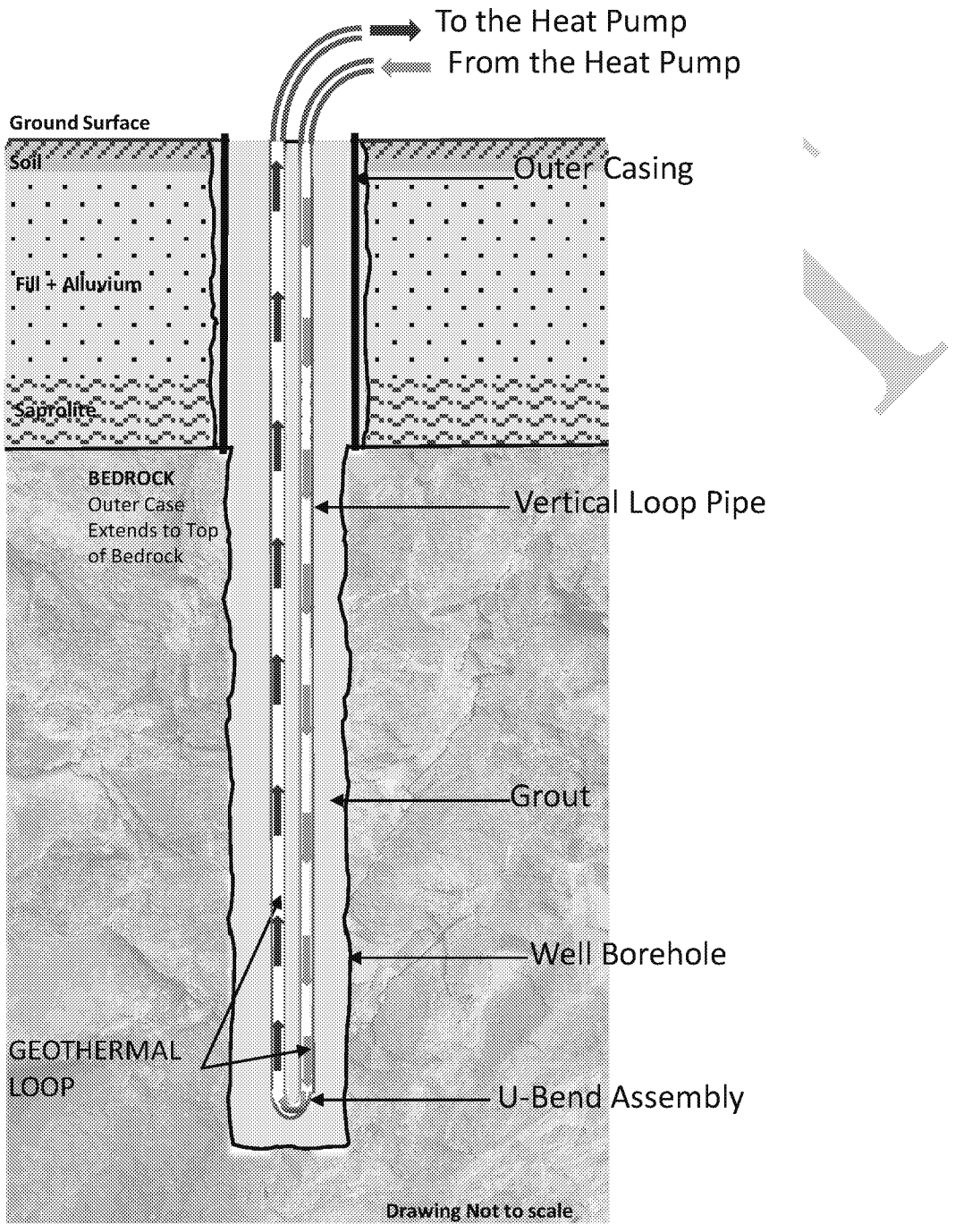


Figure 28 Typical vertical close-loop ground source heat pump installed in bedrock.

6.2 Well Construction Process

6.2.1 Applicability Standards

Any well must be constructed in accordance with a submitted Well Construction Work Plan. The applicant must provide two (2) full business days' notice to DOEE prior to commencing well construction activities and obtain public utility clearance of underground facilities with non-utility operators.

DOEE approval may be subject to additional conditions if the use of an outer-casing during the construction of a well is required. The same applies for the grouting of wells.

Lithological and geophysical data or additional analyses may be required to determine District water resources impact.

To comply with the Well Regulationsa well owner must ensure that, where applicable, the construction, maintenance and abandonment of the well is conducted in accordance with §§1809 through 1831.

Applicants should use the DOEE Well Database to ensure compliance with the standards.

6.2.2 Drilling

All well activities requiring the use of a drilling rig (drilling, construction, maintenance and abandonment), require the supervision of a licensed well driller. The District has not implemented a driller certification program; a driller license from any state is acceptable. The driller approved at the Well Construction Work Plan has to be maintained to perform the work up to completion unless, prior notification of driller's change is submitted to DOEE and the licenses of the new driller are submitted along with the notice. An amendment to the well permit will be made after DOEE's approval for the new driller to be allowed to perform the job.

Acceptable Drilling Methods

The well permit applicant must provide a complete Well Construction Work Plan that includes an appropriate drilling method for site-specific conditions. These include RECs, the suspected contamination depth to groundwater, perched water zones, and soil cohesiveness.

DOEE reserves the right to make determinations regarding the acceptable drilling methods.

Unacceptable Drilling Methods

Drilling methods for well installation that cannot advance a temporary or permanent outer-casing during drilling are considered unacceptable if any of the following conditions apply:

- Sites where known contamination or RECs are present;
- Wells that penetrate perched water or the groundwater table; or
- Wells with strong upward gradients (artesian flow)

Bucket auger and well jetting are examples of drilling methods not recommended for these conditions (EPA, 1993). Neither method can advance a casing, nor do they meet the regulatory requirements for proper well construction. Drilling methods that cannot adequately advance through hard materials such as gravel, rock, and tight clays should also not be used. Hollow-stem

auger rigs withouth previous outercasing in the shallow aquifer and bucket augers are not suitable for drilling through Arundel Clay in the District.

Direct mud rotary drilling, while typically suitable for use in the Arundel Clay, can exacerbate the vertical movement of pollutants in the subsurface. A mud rotary drill rig needs to use casing advancement such as a drill through casing driver or dual rotary advancement as a pollution preventative measure at the contaminated site, or where a groundwater contaminant plume is known or suspected to be present.

Use of Drilling Fluids

All drilling fluids used in the District must use only potable water to create a water-based drilling fluid. The use of additives must be approved by DOEE in the well construction permit application by demonstrating that the additive does not pose a hazard to public health, environment, and safety.

6.2.3 Well Construction

Cross Contamination Design Specifications

A well must not hydraulically connect otherwise confined aquifers thereby causing aquifer cross-contamination, or hydraulically connect portions of a single aquifer where contaminants exist in separate definable layers within the aquifer. Temporary or permanent outer casings are required during well construction to prevent aquifer cross-contamination at a contaminated site. The use of temporary or permanent outer casings is determined based upon the type and location of the contamination at a site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, a well owner is required to install a temporary outer casing when the drilling method does not include a dual casing and drilling fluids are used to create the borehole (e.g., direct mud-rotary drilling).

Appendix B contains a decision tree for well construction at uncontaminated or contaminated alluvium and at well sites in the Potomac Group. Use of a temporary or permanent outer casing in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Deep contaminated aquifers under confining pressure (resulting in upward vertical gradients) that are penetrated during drilling require adherence to specific protocols. A permanent outer casing should terminate in a confining unit above the contaminated zone. This casing must be grouted and allowed to set prior to advancing the borehole into the contaminated zone. The outer casing maximizes the chance of controlling artesian flow. The flow must be contained within a casing if the drilling fluid weight is insufficient to overcome the pressure of the flow and the soil must be stabilized around the wellhead. Management of contaminated derived waste (e.g., cuttings and fluids) then becomes a requirement. The use of a down-hole packer or water-tight well cap may be required if artesian flow occurs in order to minimize the volume of contaminated water discharge.

The annular space between the outer casing and well casing should be grouted. Bentonite slurry grouts have little ability to resist axial forces that can displace the grout seal in artesian flow, making bentonite grouts unsuitable for high hydraulic gradient sealing locations where strength is important. Bentonite chips or a mixture of bentonite and cement can be used depending on site conditions.

Geology

Site geology can determine how vulnerable a site is to environmental issues. Geological factors can produce aquifers that are anisotropic; groundwater moves faster in one direction than another and oblique to the hydraulic gradient. Anisotropy can result from various sedimentary or structural features such as buried channels, bedding planes, folds, faults, and fractures. In the District, most groundwater flow is either through fractured rocks from the Piedmont or granular materials from sedimentary rocks belonging to the Coastal Plain. Fracture groundwater flow in Piedmont bedrock behaves differently than flow in unconsolidated materials from the Coastal Plain. It is important to understand the geology and hydrogeology of the specific site before drilling and constructing any geothermal well system.

Well Location and Relocation

Closed-loop geothermal wells drilled and constructed must be accessible for maintenance, inspection, and abandonment, and cannot be constructed within or under any building. A utility clearance study is needed to locate utility lines. Pre-existing subsurface structures (e.g., tunnels, diversion sewers, metro) must be identified.

If the well is sited within the 100 year floodplain or other flood prone area the top of the well head must be at least 24 inches above the finished grade and fully protected from surface water intrusion. A well must be located a minimum of 25 feet of the higher watermark of any water body of the District or wetland.

Specific Siting Requirements for Closed-Loop Geothermal Wells

District Well Regulations have specific requirements for closed-loop geothermal wells. It is important to review siting requirements before applying for a well permit. If a proposed closed-loop geothermal well does not meet the siting criteria outlined in the Regulations, the well owner must submit a request to DOEE for a special compliance standard.

A closed-loop geothermal well must not be relocated from the position shown on the well construction permit. Although it may be necessary to relocate a closed-loop geothermal well due to unforeseen circumstances, required well setback distances must be observed.

Well Piping

A closed-loop geothermal system must contain pipes, loops, or loop configurations that meet the standards and specifications set forth in the *Closed-Loop/Geothermal Heat Pump Systems Design and Installation Standards, Revised Edition* (2008), published by the International Ground Source Heat Pump Association, Oklahoma State University.

If closed-loop geothermal pump well exchanger pipe and fitting materials do not meet the International Ground Source Heat Pump Association standard, proper documentation of manufacturer specifications must be supplied to DOEE in the Well Construction Work Plan for approval. The proposed pipe and fitting materials, and bonding process and procedures for their use must be in compliance with relevant District Construction Codes. The documentation should include independently-verified proof that the materials and bonding process and use procedures provide an equivalent material strength and durability such that there will not be a leak or release into the environment.

All closed-loop/geothermal pump well exchanger pipe and fitting materials must be stenciled with the applicable American Society for Testing and Materials (ASTM) standard.

Well Grouting

A request may be made to DOEE in to deviate from the grouting standards of the District Well Regulations provided the deviation does not result in a less protective standard. DOEE may impose additional requirements pertaining to the grouting of a well in the well construction permit to ensure the protection of public health and safety and the environment.

The grouting of a closed-loop geothermal well also shall meet the additional requirements listed in the District Well Regulations.

Well Caps & Upper Terminus of Well

A closed-loop geothermal well does not require a secure locking well cap. Additionally, if a closed-loop geothermal well is connected to a header outside of a building, the well owner must include adequate protective measures to prevent damage to all components of the ground source heat pump system including the piping, manifold, and header.

The Well Construction Work Plan should include a concrete vault with a manhole access cover designed to withstand maximum loads at the site where heavy equipment may impact the maximum expected loading of a standard cover.

Well Labeling

A well registration number issued by DOEE must be attached or labeled at a visible location along the supply and return line entering the building or vault. Well registration labels will be unique to each registered well.

6.2.4 Schematics

DOEE developed two general single loop well schematics to facilitate permit applications for closed-loop geothermal well construction in the District. Both schematics indicate the location of the outer casing. The schematics are based on the District Well Regulations requirements and serve as a template. See Figure 27 Outer Casing Extended to Bedrock, and Figure 28 Outer Casing Inserted into Confining Unit.

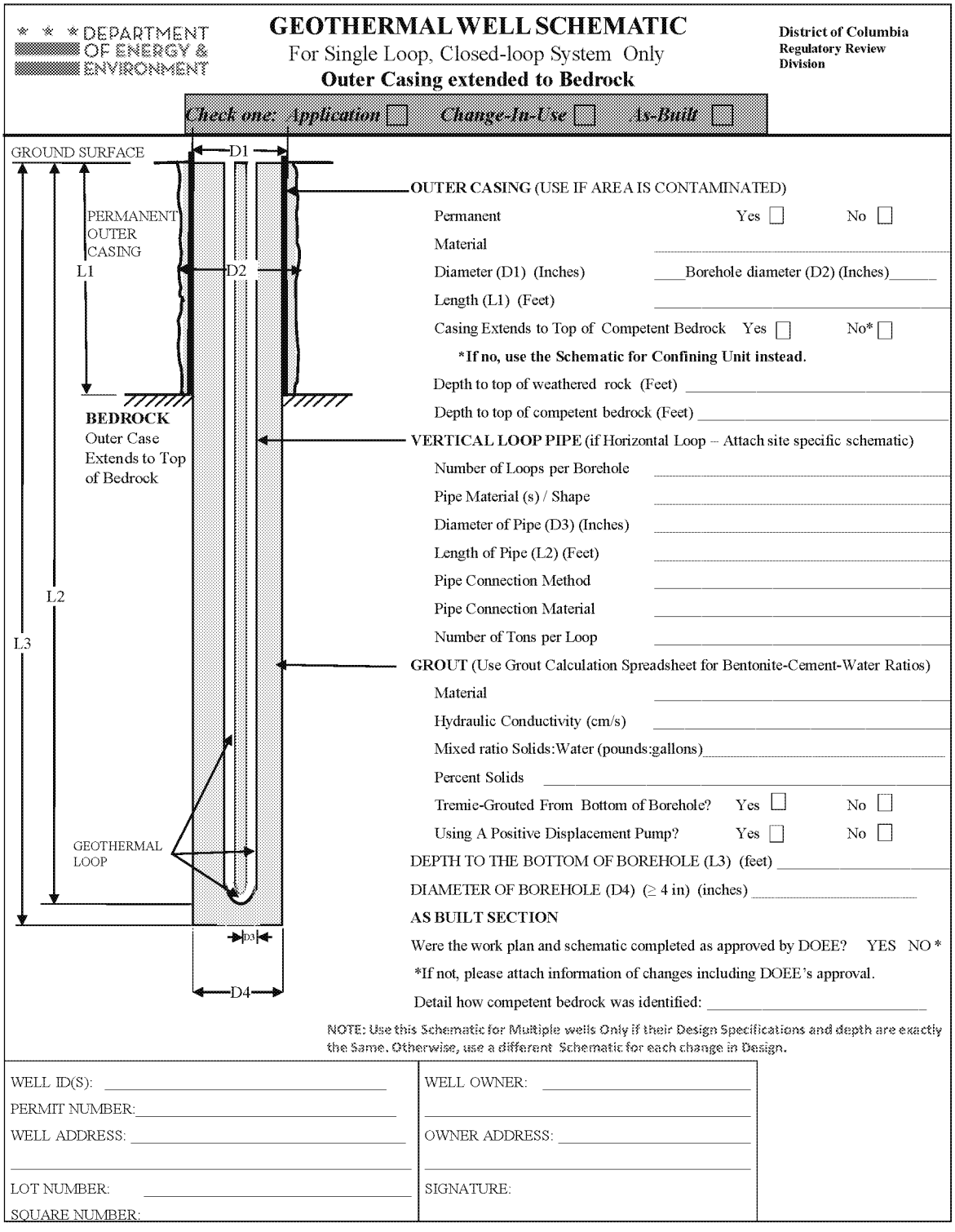


Figure 27 Geothermal well schematic, Outer Casing Extended into Bedrock.

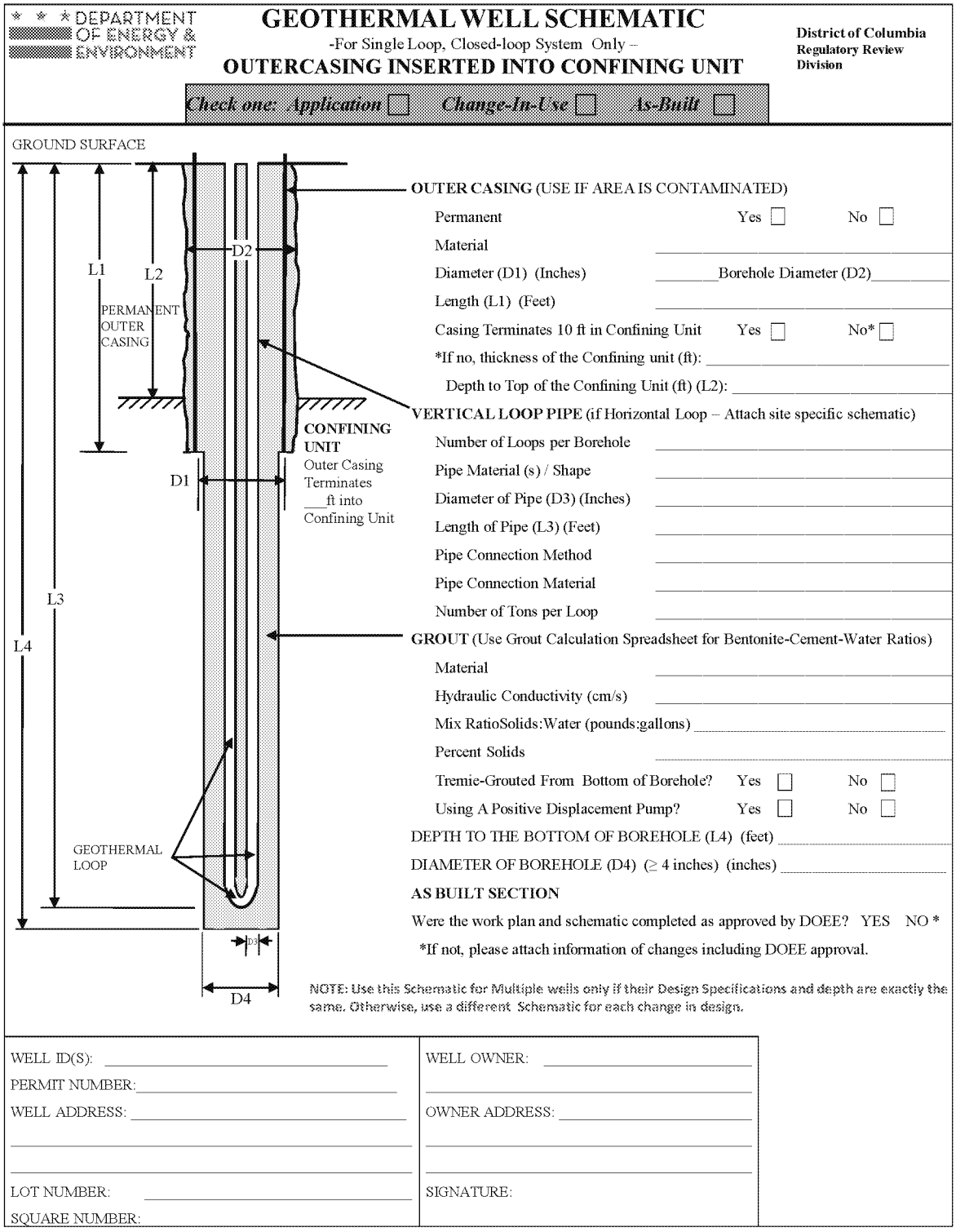


Figure 28 Geothermal well schematic, Outer Casing Inserted into Confining Unit

6.3 Well Construction Completion Report

The well applicant confirms construction of the proposed well and must include deviations from the work plan approved by DOEE using the Well Construction Completion Report. An explanation of deviations from the approved plan must be accompanied with written DOEE authorization. An as-built schematic for each one of the wells abandoned must be completed at this stage (see Section 4.3.4 Construction).

6.4 Well Use and Maintenance Requirements

Well maintenance is mandatory, and is performed to avoid impairment of the groundwater and prevent corrosion and safety hazards. If the maintenance of a closed-loop geothermal pump well requires a modification or material change to the original permitted design, specifications, use, or construction of the well, a new Well Construction Work Plan is required and must be submitted for DOEE review and approval.

An aquifer should not be used for waste disposal purposes or be significantly degraded by any means, including the discharge or infiltration of chemical, biological, or radiological materials or heat. Significant degradation includes an exceedance of the District's Ground Water Standards, adverse impact to the beneficial uses of groundwater, or an increase of the ambient groundwater temperature. As heat exchange is considered to be a beneficial use of groundwater, DOEE seeks to preserve the ability of all residents to use the resource for this purpose in a responsible and sustainable manner. Without preventative and protective measures, long-term heat exchange use of groundwater in the District will result in an overall increase in groundwater temperatures since there is a greater demand for cooling than heating in the area. Large scale dumping of heat into an aquifer will exacerbate the effect over time. DOEE prohibits open-loop geothermal wells and uses setback distances and other permitting requirements to protect the resource.

The owner of a closed-loop geothermal well has not degraded the groundwater if the resulting subsurface temperature changes in the soil or groundwater do not extend beyond the owner's property lines. A well-designed geothermal system provides sufficient spacing between loops to prevent heat interference and reduced system functionality over time, DOEE expects that the proposed design shows that there is no measurable, long-term change in ambient temperatures within the site. The well owner must ensure that temperature changes in an onsite water body do not exceed the District's surface water quality criteria (21 DCMR 11). Currently, the District standard for the maximum temperature in a waterbody is 32.2°C, with the maximum change over the ambient temperature set at 2.8°C.

A well owner must comply with buffer requirements as provided in the District's Wetland Regulations (publication pending) and siting requirements for a ground-source heat pump/geothermal well in Section 6.2.3.

6.5 Well Abandonment Process

6.5.1 Application for the Well Abandonment Work Plan

A Well Abandonment Work Plan must be submitted to DOEE 30 days before well abandonment, and abandonment of the well must be completed within 60 days of DOEE's plan approval. The

Well Abandonment Work Plan must include all details required for well abandonment by the District.

To abandon a well located on private property, the well owner will apply through the DCRA Online Permiting System. To abandon a boring or well installed in a public space, the well owner will apply through dTOPS online permitting system.

A new well permit will be given for the Well Abandonment Work Plan, yet, the original Well Construction Permit Number needs to be reported upon application for the Well Abandonment Work Plan.

All the wells that were reported completed under the construction permit number have to be accounted for in the Abandonment Work Plan in order to get DOEE approval.

Alternative Abandonment Methods

Alternative abandonment procedures such as abandoning in place should be a last resort and limited to wells with access problems. Examples include an instrument/boringdiscovered beneath a load bearing building structure where removal of the structure is required to remove the well; a well in the middle of utilities that must not be removed or damaged such as WMATA tunnels, DC Water Long Term Control Plan (LTCP) tunnels, natural gas lines, or utilities placed after the well was installed. DOEE will not approve alternative abandonment procedures for wells due to difficult, inconvenient, or more expensive site conditions such as wells near trees or in busy traffic areas that require lane closures.

The Well Abandonment Work Plan form (Appendix A) was designed to include all the details and information required for well abandonment including reason(s) for abandonment; the depth and diameter of the well; the well abandonment details, including the procedures and materials used; the details describing how any waste materials from the abandoned well or derived from well abandonment will be collected and disposed; the details regarding the well's condition and if obstructions exist that may potentially interfere with the abandonment processes; the well driller's name, address, telephone number, electronic mailing address, a copy of the pertinent Department of Consumer and Regulatory Affairs licenses, and a copy of the well driller's license; a statement signed by the well owner that the well will be abandoned in accordance with the well abandonment requirements of the well regulations; and any other relevant details.

6.5.2 Procedures

The accepted well abandonment procedures in the District are listed in Regulation §1831.15.

It is strongly recommended that during the abandonment of a closed-loop/geothermal well, all piping, magnetic tape, and other associated material and structures that will no longer be in use after abandonment be removed.

The well must be grouted according to procedures listed in Chapter 13.5, and the upper five (5) feet of borehole restored with suitable materials to create a cover similar to that of the surrounding area, such as concrete, asphalt, native soils, or a combination of these materials.

Acceptable Abandonment Procedures

Rip or perforate the well casing below ground surface - Rip or perforate the casing followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting

of the well annulus or the well annulus was allowed to be backfilled with cuttings. The grout will flow through the openings or perforations to seal any porous zones along the outside of the casing. A minimum of five perforations per linear foot of casing or screen is recommended (American Society for testing Materials, Standard D 5299-99, 2012). After the rip or perforating is complete, the borehole must be grouted according to the procedures listed on chapter 13.5 and the upper five (5) feet of borehole restored with suitable materials to create a cover similar to the surrounding area such as concrete, asphalt, native soils, or a combination of these materials.

Over-drill the well casing for removal - Over-drilling is the abandonment technique used to remove an entire well, its sand or gravel pack, and the old grout column and fill. In situations where PVC screens and risers are expected to be severed and removal of all well materials is required, the over-drilling technique is required. Over-drilling is used when a riser cannot be pulled and it penetrates a confining layer.

A temporary casing may be required when conditions are present such a high concentrations of mobile contaminants in upper layers (fill, alluvium, or granular materials), depth to water is shallow or there are perched aquifer conditions, there is poor construction documentation, or construction practices were used. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling, pulling, and grouting within this casing. The casing is recovered at the end of pulling, grouting, and drilling. If the confining unit is less than five (5) feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of two (2) feet below the top of the confining layer. After the outer casing is set, the well can be removed and grouted through pulling, if possible, or removed and grouted by drilling inside the casing.

Over-drilling is recommended where casing pulling is determined to be unfeasible, or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled.

As a precaution, the well column should be filled with grout before over-drilling.

Prior to over-drilling, the bottom of the well should be perforated or cut away and the casing filled with grout.

Over-drilling should advance beyond the original bore depth by a distance of half-a-foot (six inches) to ensure complete removal of the construction materials.

- Submit an alternate abandonment procedure to the Department for approval in accordance with §§ 1803.10 and 1803.11.

In any method selected by the applicant, DOEE expects that the abandoned well will be filled and sealed in an effective and permanent manner that prevents vertical fluid migration within the well or the annulus surrounding the well casing.

6.5.3 Well Abandonment Report

To complete the Well Abandonment process, the well owner must submit a Well Abandonment Report to DOEE within 60 days of completing the well abandonment work, that includes answering all the questions regarding the construction procedure followed and the deviations of

the DOEE's approved work plan. Uploading the Well Abandonment Record sketch from Figure 17 will follow. Photographs of the entire well abandonment work will be uploaded at that time.

A well Abandonment Report submitted to DOEE must include the relevant DC Well Abandonment and/or DC Well Construction Completion forms. If more than one well was abandoned, the applicant will be asked to provide a well matrix/schedule accounting for all wells and borings installed under the same Well permit number regardless of whether or not they are abandoned or still in use when submitting Abandonment information. The matrix/schedule should provide the following details:

- Well Identification Number
- Date of completed abandonment
- Type of well
- Borehole depth below ground surface
- Borehole diameter
- Screened interval, if applicable
- Geologic formation or aquifer the well is/was screened in (if known)
- Well location coordinates using Maryland State Plane Coordinate System or Latitude and Longitude
- Well elevation using NAV83.
- A site map drawn to scale with a north arrow, property lines, building footprints, the nearest street intersection, and the locations of all borings or wells regardless of whether or not they are abandoned or still in use
- A scaled site map with scale bar
- A north arrow
- Property lines showing public space
- Building footprints
- The nearest street intersection
- Photographs showing the entire abandonment procedure (they have to show at least a picture of the boring/well before the abandonment, the equipment at the moment of the abandonment procedure and the photograph of the site after the boring/well abandonment.
- All the boring logs generated under the well permit if the were not submitted at the completion report stage.
- Any additional comments including deviations of the Well Abandonment Work Plan Approved.

6.6 Well Close-Out

Once DOEE approves the Well Abandonment Report and if all the stages were completed according to the regulations, the well owner will receive an email confirming the well close-out.

6.7 General Specifications

For general specifications related to contaminated sites, grouting and sealing, and derived material management and decontamination refer to Chapter 13.

Chapter 7 Ground Freeze Well Requirements

7.1 Definition and Purpose

Ground Freeze Well – a well that is constructed for the installation of subsurface freeze pipes designed to freeze the surrounding soil and groundwater to increase their combined strength and create an impervious strata; ground freezing is typically used for construction of shafts, deep excavations, tunnels, groundwater control, structural underpinning, and containment of hazardous waste.

Ground freezing is used for groundwater cutoff, earth support and stabilization, and temporary underpinning to arrest landslides and stabilize abandoned mineshafts.

During ground freezing, a row of freeze pipes (ground freeze wells) are placed vertically in the soil and heat energy is removed through them in a process analogous to pumping groundwater from wells (dewatering). When the Earth's temperature reaches 32°F (0°C), water in the soil pores turns to ice. Then further cooling proceeds.

A Ground Freeze well changes the ambient temperature in the surrounding subsurface materials (that is, the soil and groundwater) during the system operation, until the frozen ground completely thaws out. This can affect nearby sensitive ecological receptors and Waters of the District. Ground heaving can be common and nearby structures and utilities can also be affected. Spills and releases are possible where circulating fluid is stored, mixed and pumped throughout the ground freeze system. Therefore, hazardous materials stored and mixed on site should have appropriate secondary containment and other pollution prevention and response measures to prevent impact to human health and the environment. A typical schematic of a ground freeze well most commonly referred in the practice as freeze pipe is presented in figure 29.

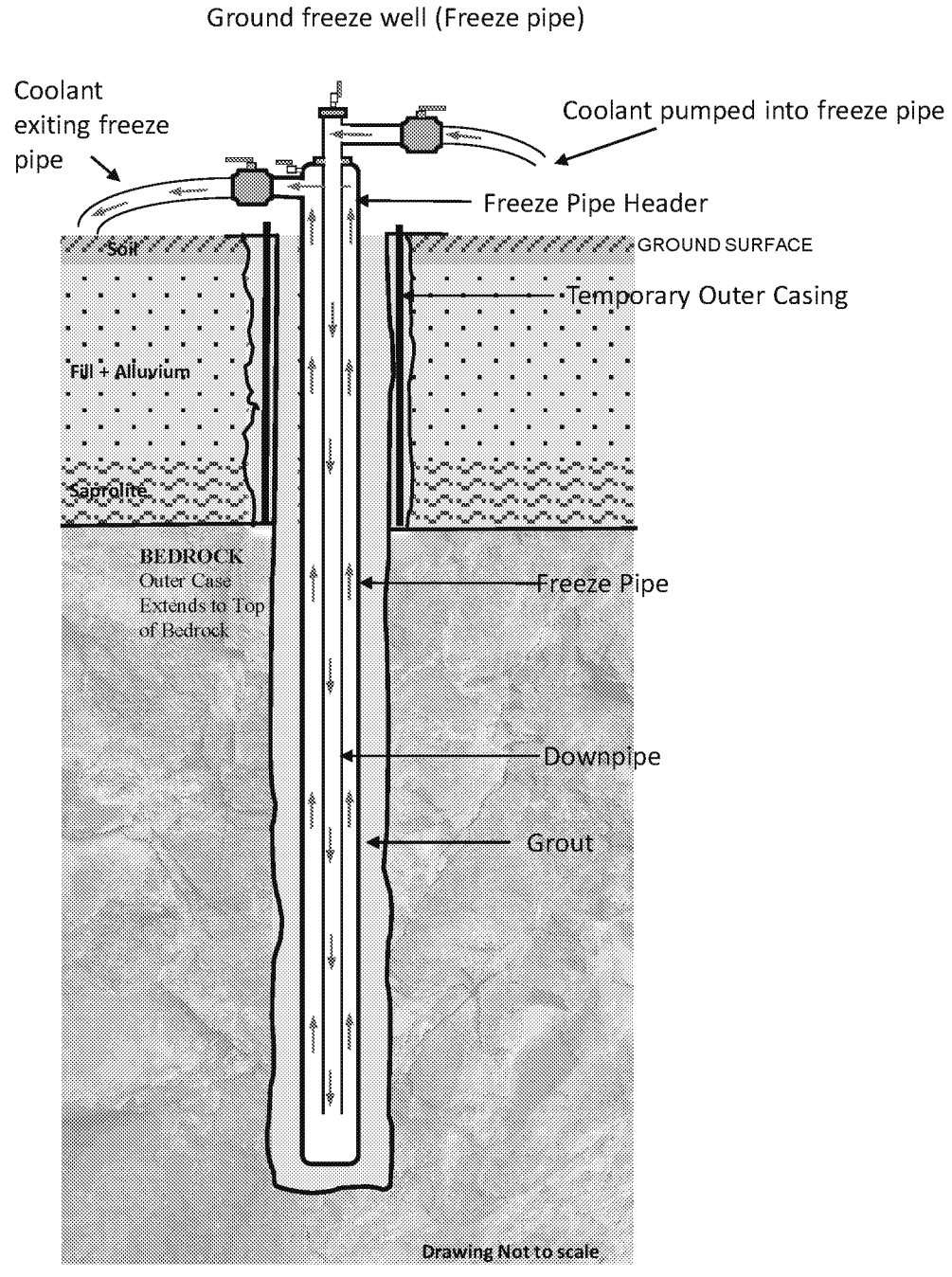


Figure 29 Typical schematic of a ground freeze well (Freeze pipe)

7.2 Ground Freeze Well Objectives and Environmental Issues

As the construction and operation of a Ground Freeze well and a Ground Source Heat Pump Well, also known as a Geothermal well, share many similarities, DOEE will apply the same principles used for a Geothermal well system, where practicable, to regulating a Ground Freeze well system, except where the Well Regulations specify otherwise.

The circulating fluid for the Ground Freeze well should not be toxic and the downhole piping and ground freeze distribution manifold shall not contain any substances that pose a hazard to public health and safety or the environment.

7.3 Well Construction Process

7.3.1 Applicability Standards

Any well must be constructed in accordance with a submitted Well Construction Work Plan. The applicant must provide two (2) full business days' notice to DOEE prior to commencing well construction activities and obtain public utility clearance of underground facilities with non-utility operators.

DOEE approval may be subject to additional conditions if the use of an outer-casing during the construction of a well is required. The same applies for the grouting of wells.

Lithological and geophysical data or additional analyses may be required to determine District water resources impact.

To comply with the Well Regulationsa well owner must ensure that, where applicable, the construction, maintenance and abandonment of the well is conducted in accordance with §§1809 through 1831.

Applicants should use the DOEE Well Database to ensure compliance with the standards

7.3.2 Drilling

All well activities requiring the use of a drilling rig (drilling, construction, maintenance and abandonment), require the supervision of a licensed well driller. The District has not implemented a driller certification program; a driller license from any state is acceptable. The driller approved at the Well Construction Work Plan has to be maintained to perform the work up to completion unless, prior notification of driller's change is submitted to DOEE and the licenses of the new driller are submitted along with the notice. An amendment to the well permit will be made after DOEE's approval for the new driller to be allowed to perform the job.

Acceptable Drilling Methods

The well permit applicant must provide a complete Well Construction Work Plan that includes an appropriate drilling method for site-specific conditions. These include RECs, the suspected contamination depth to groundwater, perched water zones, and soil cohesiveness.

DOEE reserves the right to make determinations regarding the acceptable drilling methods.

Unacceptable Drilling Methods

Drilling methods for well installation that cannot advance a temporary or permanent outer-casing during drilling are considered unacceptable if any of the following conditions apply:

- Sites where known contamination or RECs are present;
- Wells that penetrate perched water or the groundwater table; or
- Wells with strong upward gradients (artesian flow)

Bucket auger and well jetting are examples of drilling methods not recommended for these conditions (EPA, 1993). Neither method can advance a casing, nor do they meet the regulatory requirements for proper well construction. Drilling methods that cannot adequately advance through hard materials such as gravel, rock, and tight clays should also not be used. Hollow-stem auger rigs withouth previous outercasing in the shallow aquifer and bucket augers are not suitable for drilling through Arundel Clay in the District.

Direct mud rotary drilling, while typically suitable for use in the Arundel Clay, can exacerbate the vertical movement of pollutants in the subsurface. A mud rotary drill rig needs to use casing advancement such as a drill through casing driver or dual rotary advancement as a pollution preventative measure at the contaminated site, or where a groundwater contaminant plume is known or suspected to be present.

Use of Drilling Fluids

All drilling fluids used in the District must use only potable water to create a water-based drilling fluid. The use of additives must be approved by DOEE in the well construction permit application by demonstrating that the additive does not pose a hazard to public health, environment, and safety.

7.3.3 Well Construction

Cross Contamination Design Specifications

A well must not hydraulically connect otherwise confined aquifers thereby causing aquifer cross-contamination, or hydraulically connect portions of a single aquifer where contaminants exist in separate definable layers within the aquifer. Temporary or permanent outer casings are required during well construction to prevent aquifer cross-contamination at a contaminated site. The use of temporary or permanent outer casings is determined based upon the type and location of the contamination at a site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, a well owner is required to install a temporary outer casing when the drilling method does not include a dual casing and drilling fluids are used to create the borehole (e.g., direct mud-rotary drilling) does not include dual casing and drilling fluids are used to create the borehole.

Appendix B contains a decision tree for well construction at uncontaminated or contaminated fill/alluvium and at well sites in the Potomac Group. Use of temporary or permanent outer casing in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Contaminated deeper aquifers under confining pressure (resulting in upward vertical gradients) that are penetrated during drilling require adherence to specific protocols. A permanent outer casing should terminate in a confining unit above the contaminated zone. This casing will be grouted and allowed to set prior to advancing the borehole into the contaminated zone. The outer casing will maximize chances of controlling artesian flow; contain the flow within a casing if drilling fluid weight is insufficient to overcome the pressure of the flow; and stabilize the soil around the wellhead. Management of contaminated derived waste (e.g., cuttings and fluids) then becomes a requirement. The use of a down-hole packer or water-tight well cap may be required if artesian flow occurs to minimize the volume of contaminated water discharging from the well.

The annular space between the outer casing and well casing should be grouted. Bentonite slurry grouts have little ability to resist axial forces that can displace the grout seal in artesian flow, making bentonite grouts unsuitable for high hydraulic gradient sealing locations where strength is important. Bentonite chips or a mixture of bentonite and cement can be used depending on site conditions.

Geology

Geological factors can produce aquifers that are anisotropic. In an anisotropic aquifer, groundwater moves faster in one direction than another and oblique to the hydraulic gradient. Anisotropy can result from various sedimentary or structural features such as buried channels, bedding planes, folds, faults, and fractures. In The District of Columbia, most of groundwater flow is either through fractured rocks from the Piedmont or granular materials from sedimentary rocks belonging to the Coastal Plain. Fracture flow in Piedmont bedrock requires additional considerations compared to flow in unconsolidated materials from the Coastal Plain.

Bedrock may exhibit small effective porosities and low hydraulic conductivities that impede groundwater flow. However, its secondary porosity may allow substantial flow of groundwater through fractures, joints, cleavage planes and foliations. These features tend to be highly directional, exhibit varying degrees of interconnection, and may produce local groundwater flow regimes that can be different from the regional trends. The sedimentary bedding planes and distribution and nature of the Coastal Plain also have significant effect on groundwater flow, presenting a series of aquifers and aquitards at different depths. The recent sedimentary deposits (alluvium, artificial sill and fluvial terraces) and the weathered bedrock (Saprolite) conform most of the District unconfined aquifer including perched groundwater conditions in the Coastal Plain area of the District. It is important to understand and take into consideration the characteristics of the Hydrogeologic System of DC before designing any ground freeze project in order to achieve the effectiveness of the system and the protection of the District's groundwater.

Well Location and Relocation

Ground Freeze wells drilled and constructed must be accessible for maintenance, inspection, and abandonment, and cannot be constructed within or under any building. A utility clearance study is needed to locate utility lines. Pre-existing subsurface structures (e.g., tunnels, diversion sewers, metro) must be identified.

If the well is sited within the 100 year floodplain or other flood prone area the top of the well head must be at least 24 inches above the finished grade and fully protected from surface water intrusion. A well must be located a minimum of 25 feet of the higher watermark of any water body of the District or wetland.

The relocation of a well during construction for the avoidance of utility lines and other obstacles can be done if the relocation is not more than ten feet (10) from the approved location and belongs to the same lot and square number and if drilled, the unsuccessful well has been properly abandoned in accordance with the requirements of the well regulations. Well setback distances required in the Well Regulations shall be maintained.

Sanitary Protection

Sanitary protection has to be properly installed for each well and conduct protective measures during the well construction to protect the well and any water-bearing formation against contaminants from any source and surface water drainage.

If contaminants not addressed in the well construction permit are found during the drilling, the responsible of the well should stop the well construction, notify DOEE and follow the procedure described in the well regulations.

Piping and Other Materials

The well materials, piping, fittings, and equipment, must be appropriate, and approved by the American Society for Testing and Materials (ASTM), According to the Well Regulations (§1824), ASTM standard A-120/A-53 steel must be used for subsurface freeze pipes, unless an approved well work plan is approved by DOEE and do not poses a hazard to public health and Safety. Additional details can be found in the well regulations (§§ 1803.10 and 1803.11).

Well Grouting

A request may be made to DOEE in accordance with §1803.10 and §1803.11 to deviate from the grouting standards of the well regulations, provided the deviation does not result in a less protective standards than those set forth in the Well Regulations.

DOEE may impose additional requirements pertaining to the grouting of a well in the well construction permit to ensure the protection of public health and safety and the environment.

Grouting

A well shall be grouted as soon as feasible, but not later than twenty-four (24) hours after the well casing has been set in place, unless otherwise specified in the well construction permit or well construction work plan.

In addition to §1818 specifications regarding grouting, a sodium-based bentonite grout should be fully hydrated in accordance with the manufacturer's specifications. Over hydration can lead to slumping and cracking when the grout begins to dry out above the saturated zone. The choice between a pure sodium-based bentonite grout and a sodium-based bentonite-cement mixture that is predominantly comprised of cement is dependent on the intended use of the grout and site conditions.

Well Caps & Upper Terminus of Well

A ground freeze well constructed for temporary construction applications will be exempt from well cap and upper terminus requirements provided all the conditions of the Well Regulations (§1820.3) are met.

Well Labeling

According to the Well Regulations, a ground freeze well constructed for temporary construction applications will not require a well registration label, if the well is sited within a secure perimeter; the well completion details are maintained at the property; and the well is abandoned within thirty (30) days of well completion.

7.3.4 Schematics

DOEE developed two general ground freeze well schematics to facilitate permit applications for ground freeze wells construction in the District. Both schematics indicate the location of the outer casing. The schematics are based on the District Well Regulations requirements and serve

as a template. See Figure 30 Outer Casing Extended to Bedrock, and Figure 31 Outer Casing Inserted into Confining Unit.

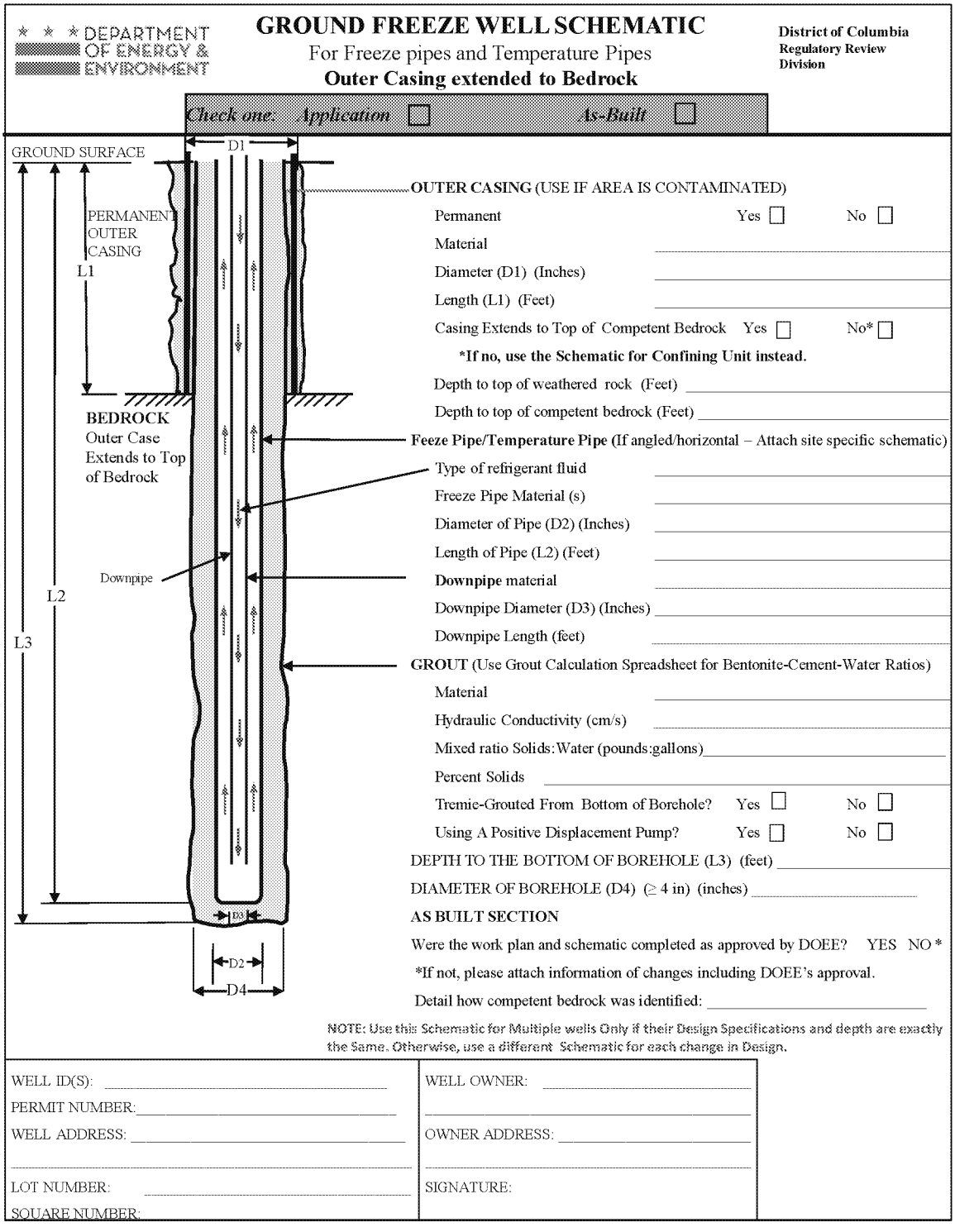


Figure 30 Ground freeze well schematic with outer casing extended into bedrock.

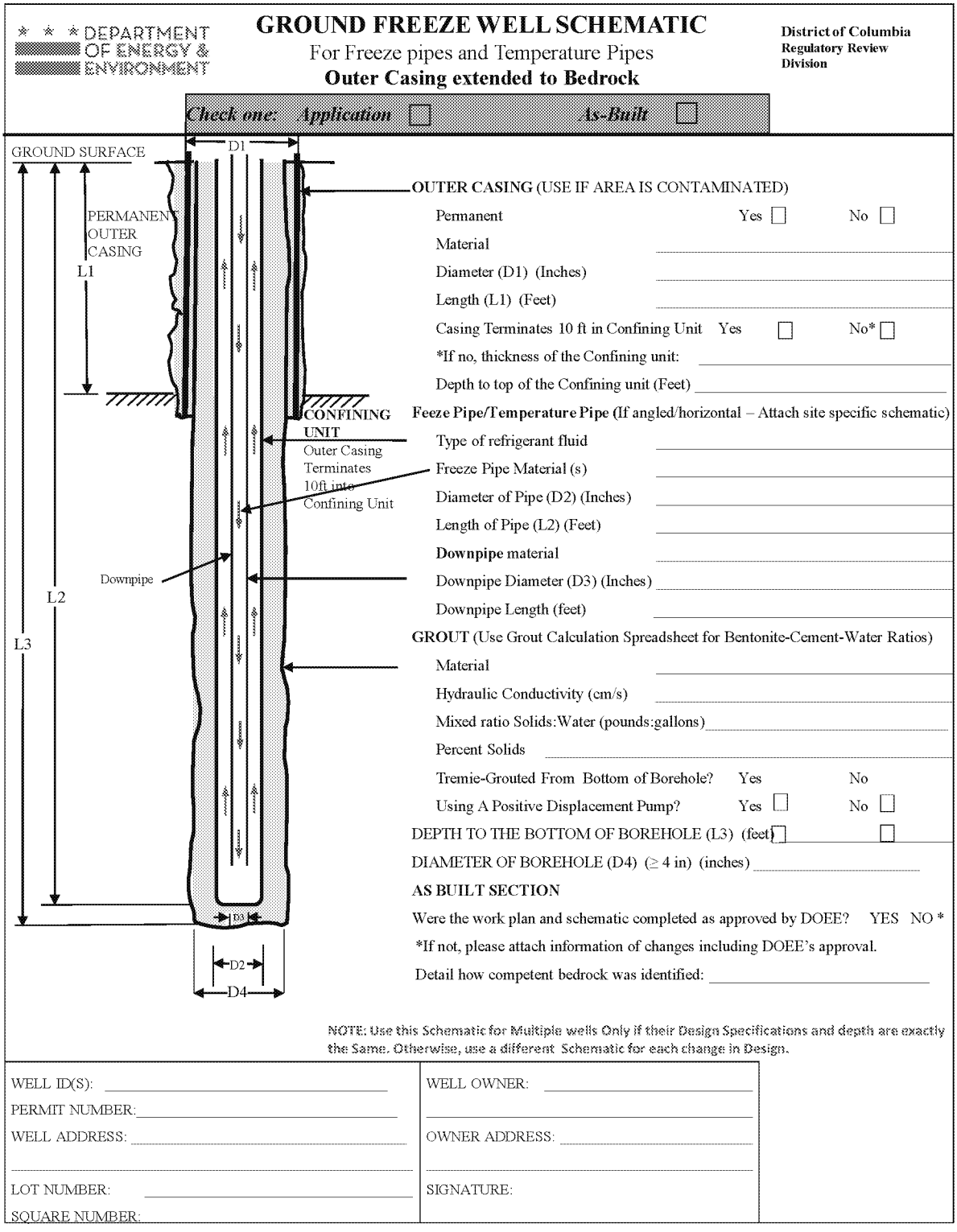


Figure 31 Ground freeze well schematic with outer casing inserted into confining unit

7.4 Well Construction Completion Report

The well applicant confirms construction of the proposed well and must include deviations from the work plan approved by DOEE using the Well Construction Completion Report. An explanation of deviations from the approved plan must be accompanied with written DOEE authorization. An as-built schematic must be completed at this stage (see Section 7.3.3 Construction).

7.5 Well Use and Maintenance Requirements

Well maintenance is mandatory, and is performed to avoid impairment of the groundwater and prevent corrosion and safety hazards. A Well Owner must repair or replace broken, punctured, or otherwise defective or unserviceable well casing, well screen, fixtures, seals, or any part of the well head, or the Well Owner shall properly abandon and seal the well as specified in §1830 and §1831.

7.6 Well Abandonment Requirements

7.6.1 Application for the Well Abandonment Work Plan

A Well Abandonment Work Plan must be submitted to DOEE 30 days before well abandonment, and abandonment of the well must be completed within 60 days of DOEE's plan approval. The Well Abandonment Work Plan must include all details required for well abandonment by the District.

To abandon a well located on private property, the well owner will apply through the DCRA Online Permiting System. To abandon a boring or well installed in a public space, the well owner will apply through dTOPS online permitting system.

A new well permit will be given for the Well Abandonment Work Plan, yet, the original Well Construction Permit Number needs to be reported upon application for the Well Abandonment Work Plan.

All the wells that were reported completed under the construction permit number have to be accounted for in the Abandonment Work Plan in order to get DOEE approval.

Alternative Abandonment Methods

Alternative abandonment procedures such as abandoning in place abandoning the freeze and temperature pipes in place it is likely to be proposed and be reviewed by DOEE case by case basis. DOEE will not approve alternative abandonment procedures for wells due to difficult, inconvenient, or more expensive site conditions such as wells near trees or in busy traffic areas that require lane closures.

The Well Abandonment Work Plan form (Appendix A) was designed to include all the details and information required for well abandonment including reason(s) for abandonment; the depth and diameter of the well; the well abandonment details, including the procedures and materials used; the details describing how any waste materials from the abandoned well or derived from well abandonment will be collected and disposed; the details regarding the well's condition and if obstructions exist that may potentially interfere with the abandonment processes; the well

driller's name, address, telephone number, electronic mailing address, a copy of the pertinent Department of Consumer and Regulatory Affairs licenses, and a copy of the well driller's license; a statement signed by the well owner that the well will be abandoned in accordance with the well abandonment requirements of the well regulations; and any other relevant details.

7.6.2 Procedures

The abandoning of a ground freeze well shall comply with the applicable steps for ground freeze wells from the Regulations procedure §1831.15 and can be conducted as described below:

- Capture any circulation fluids and flush the piping with potable water to remove all contaminants;
- After pressure testing and flushing the system, remove the inner piping;
- Grout the steel freeze pipes and temperature pipes with low-permeability grout equal to or less than 1 x 10-7 cm/s using a tremie pipe;
- Cut off the steel freeze and temperature pipes at least five feet (2 ft) below the ground surface and seal it with a permanent cap;
- If gaps are found in the annulus grout seal during the decommissioning process, pump grout into the deficient borehole annulus in a continuous operation until undiluted grout returns to the surface;
- If there is visual evidence of subsidence greater than one foot (1 ft) at a well, excavate the ground to the top of the well, and grout the open well using a tremie pipe or by surface methods; and
- If contaminants are known or suspected to have entered a damaged pipe, purge the pipe again, fill it with low-permeability grout equal to or less than 1 x 10-7 cm/s using a tremie pipe and seal.

7.6.3 Well Abandonment Report

To complete the Well Abandonment process, the well owner must submit a Well Abandonment Report to DOEE within 60 days of completing the well abandonment work, that includes answering all the questions regarding the construction procedure followed and the deviations of the DOEE's approved work plan. Uploading the Well Abandonment Record sketch from Figure 17 will follow. Photographs of the entire well abandonment work will be uploaded at that time.

A well Abandonment Report submitted to DOEE must include the relevant DC Well Abandonment and/or DC Well Construction Completion forms. If more than one well was abandoned, the applicant will be asked to provide a well matrix/schedule accounting for all wells and borings installed under the same Well permit number regardless of whether or not they are abandoned or still in use when submitting Abandonment information. The matrix/schedule should provide the following details:

- Well Identification Number
- Date of completed abandonment
- Type of well
- Borehole depth below ground surface

- Borehole diameter
- Screened interval, if applicable
- Geologic formation or aquifer the well is/was screened in (if known)
- Well location coordinates using Maryland State Plane Coordinate System or Latitude and Longitude
- Well elevation using NAV83.
- A site map drawn to scale with a north arrow, property lines, building footprints, the nearest street intersection, and the locations of all borings or wells regardless of whether or not they are abandoned or still in use
- A scaled site map with scale bar
- A north arrow
- Property lines showing public space
- Building footprints
- The nearest street intersection
- Photographs showing the entire abandonment procedure (they have to show at least a picture of the boring/well before the abandonment, the equipment at the moment of the abandonment procedure and the photograph of the site after the boring/well abandonment.
- All the boring logs generated under the well permit if the were not submitted at the completion report stage.
- Any additional comments including deviations of the Well Abandonment Work Plan Approved.

7.7 Well Close-Out

Once DOEE approves the Well Abandonment Report and if all the stages were completed according to the regulations, the well owner will receive an email confirming the well close-out.

7.8 General Specifications

For general specifications related to contaminated sites, grouting and sealing, and derived material management and decontamination refer to Chapter 13.

Chapter 8 Dewatering Well Requirements

8.1 Definitions

- Well – any test hole, shaft, or soil excavation created by any means including, but not limited to, drilling, coring, boring, washing, driving, digging, or jetting, for purposes including, but not limited to, locating, testing, diverting, artificially recharging, or withdrawing fluids, or for the purpose of underground injection. [Statutory]
- Dewatering Well – a well-used to lower groundwater levels for construction such as for footings, sewer lines, building foundations, elevator shafts, or parking garages.
- The construction and use of a well pit, sump pit, or other similar structure installed or constructed below ground surface that can withdraw groundwater or otherwise impact the water resources of the District are considered to be a dewatering well and are regulated in accordance with the requirements of 21 DCMR 18.

8.2 Applicable Forms, Work Plans, and Supplemental Guidance Documents

Provided below is a list of applicable forms, work plans and supplemental guidance documents over the life cycle of a well. The applicability of these documents may vary based on the specific requirements and site conditions for the well construction, maintenance, and abandonment activities. Refer to Section 1.5 of this Well Guidance Document for more detailed information.

- Dewatering Well Construction Permit Application/Registration Form
- Well Construction Completion Form
- Well Development Log Form
- Well Pumping Test Application Form
- Well Additional Geographic Data Form
- Well Abandonment Application Form
- Well Abandonment Form
- Well Registration Form/Completion Form (applicable for a well permitted before the Well Regulations were promulgated)
- Well Change-In-Use Form
- Well Change-in-Ownership Form
- Well Construction Work Plan
- Flow Chart of DCRA Well Permitting Process for Private-Space Property
- Flow Chart of DOEE Application/Registration Process for Well Permit Applications

- Flow Chart of Well Permitting Process for Regulatory Reviews of Other agencies and divisions
- Flow Chart of Dewatering Well Modeling Requirements for Well Permit Applications
- DC Map of Known Wetlands and Waterbodies
- Hydraulic Conductivity Chart of Borehole Sealants
- District of Columbia Geologic Map
- Multiple Well-Boring Data Collection Sheet
- Grouting Calculation of Bentonite-Cement-Water Ratios

DOEE has prepared a list of instructions for each Form and Spreadsheet to assist applicants with their completion.

8.3 Dewatering Wells Objectives and Environmental Issues

Dewatering involves controlling groundwater by pumping, to locally lower groundwater levels in the vicinity of the excavation.

District of Columbia's groundwater is a critical resource that provides environmental benefits and contributes to the well-being of the citizens of the District and, in specific cases, a source of water.

Groundwater supply is not currently the source of drinking water of the District, but future needs or emergency situations could change this. In the past it represented the only practical source of water for domestic uses. Preserving the quality of groundwater is important for its potential use as source of water and for any other use. Additionally, groundwater is critical to the protection of The District's surface streams since it provides the sustaining baseflow to the District's surface waters.

Adequate protection of the District's groundwater requires that the dewatering operations in the District always consider the possible long and short term environmental effects of dewatering. This chapter is intended to provide guidance on implementation of the Well Regulations for dewatering wells.

In order to comply with the Well Regulations, is strongly recommended that a Person conducting dewatering activities will take all reasonable and practicable measures to:

- • ensure all groundwater that is discharged from a site into receiving waters is adequately treated to the point to not to exceed DC surface water quality standards and disposed of so as not to create an environmental nuisance or an impact or threat of an impact to the Waters of the District;
- ensure all contaminated groundwater that is to be treated off-site is done so in accordance with District and Federal laws and regulations;
- prevent the emission of nuisance odors associated with the dewatering process;
- ensure there is no scouring or erosion at the point of discharge into the receiving waters;
- manage and resolve any complaints generated by the activity.

Management of dewatering fluids requires advanced planning, special equipment and often NPDES discharge permit approvals from EPA and certifications from DOEE. A representative sample of dewatering fluid is to be obtained and analyzed as a part of the Well Construction Work Plan. Further in-situ water quality testing may be needed pending the results of the Environmental Site Assessment required for dewatering sites as discussed in Section 15. Water quality samples should be collected from aquifer zones that are anticipated to be affected by the proposed dewatering. The zone of influence and drawdown should be determined by conducting analytical or numerical models presented in this section. The parameters and values used to conduct this modeling should be based on site-specific field test data, as much as possible. RECs identified and specific contaminants may require fate and transport modeling to predict concentration ranges in dewatering fluids. Discharge locations and associated approvals can then be coordinated.

8.4 Requirements and Groundwater Modeling

An estimate of dewatering volumes, rates and associated water level drawdown impacts are required for all dewatering wells to be permitted by DOEE. A Flow Chart of Dewatering Well Modeling Requirements for Well Permit Applications is included in Figure 12.

The applicant shall use a standard numerical groundwater flow model preferably USGS MODFLOW simulation code. The applicant can download free of charge the MODFLOW code variants and the MODFLOW utilities, Post processors, and Graphical User Interfaces (GUIs) software from the USGS website: http://water.usgs.gov/ogw/modflow/. Acceptable analytical models are those recognized and used extensively in the practice to estimate the performance of dewatering systems and are applied with judgment and the values assumed for variables are appropriate, so the estimates are reliable. Full model documentation should be provided as part of the permit application.

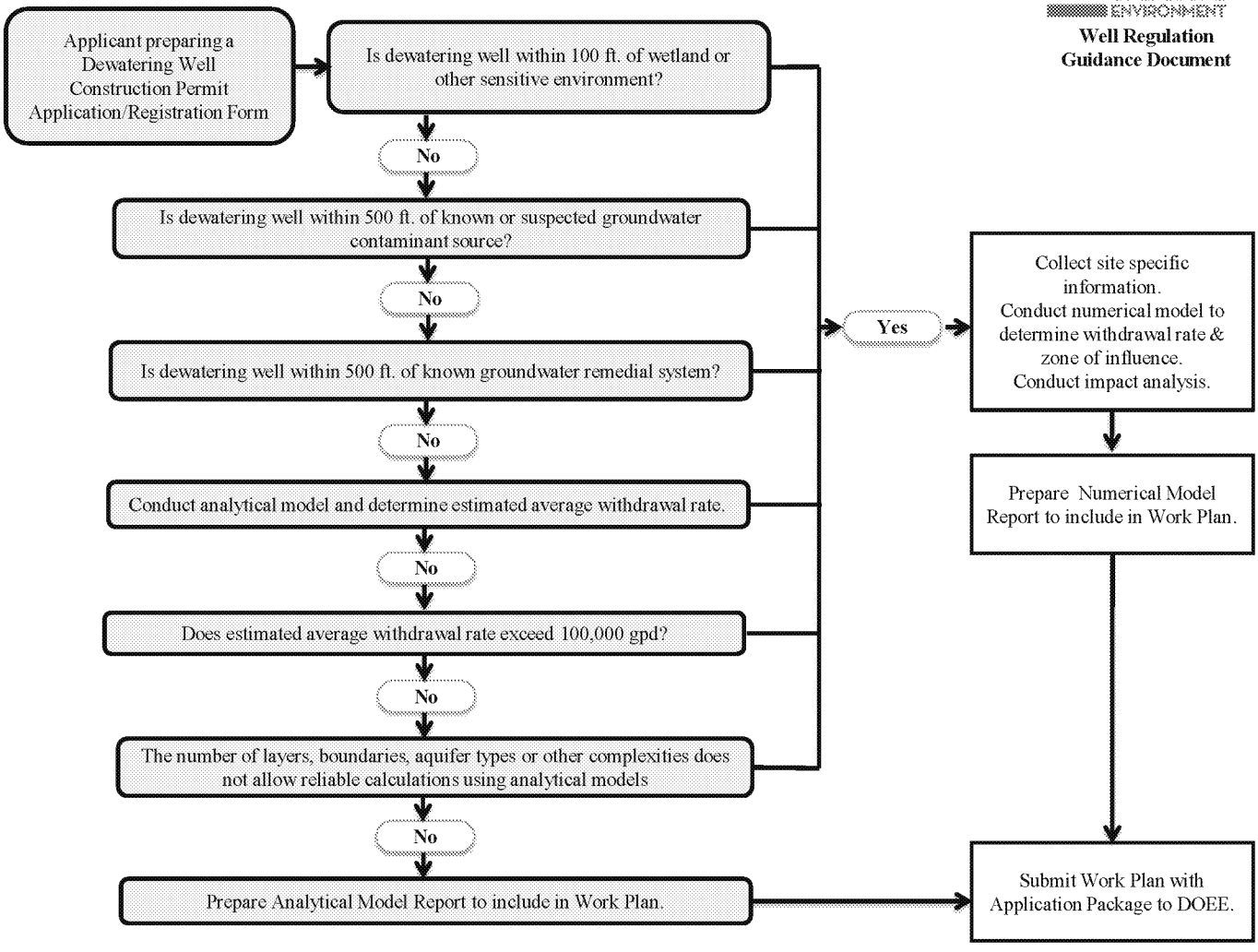


Figure 31 Flow chart of dewatering well modeling requirements for well permit applications.

8.4.1 Dewatering Withdrawal Modeling – Numerical Model

Numerical Modeling of dewatering withdrawals is required when any of the following apply:

- A Dewatering Well is proposed within 100 feet of a wetland or other sensitive environments. Sensitive environments may include streams, state or federally protected wetlands, designated groundwater recharge areas, and any wells in the Patapsco, Patuxent or Bedrock Aquifer;

- A Dewatering Well is proposed within 500 feet of a known or suspected groundwater contaminant area;
- A Dewatering Well is proposed within 500 feet of a known groundwater remedial system;
- Dewatering Well is proposed that has dewatering rates that exceed 100,000 gallons per day as estimated by conducting an Analytical Model of the withdrawal;
- A dewatering area consisting of multiple dewatering wells where the combined dewatering rates exceed 100,000 gallons per day as estimated by conducting an Analytical Model of the withdrawal; and
- The number of layers, boundaries, aquifer types or other complexities does not allow reliable calculations using an Analytical Model.

A numerical groundwater model requires site specific data collection to determine baseline water levels, hydraulic conductivity and aquifer saturated thickness. Baseline water level monitoring is required at the proposed dewatering well and in a minimum of two locations within 100 feet of the dewatering well.

A numerical model report will require the following information to be supplied to DOEE:

1. Conceptual Site Model both in plan-view and cross-sectional view;
2. Name and Qualifications of Environmental Professional Conducting the Model. It is required that a licensed or certified geologist or engineer (with past experience with groundwater modeling) conduct or directly supervise the modeling;
3. Model Information;
4. Model Name and developer;
5. Type of Model and version;
6. Intended Model Use and Applications;
7. Model Limitations;
8. Model Input Parameters and Assumptions;
9. Reference Input Parameter Sources;
10. Model Calibration;
11. Sensitivity and Error Analyses;
12. Model Output;
13. Withdrawal rates required in units of gallons per minute as an average;
14. Dewatering zone of influence superimposed on plan-view site map with estimated drawdown contours is required;
15. Impact Analyses;
16. Conclusions on impacts to wetlands, sensitive environments, groundwater contaminant sources and other water users are to be presented; and

17. Contaminant concentrations are to be estimated if a groundwater contaminant source is located within the zone of influence.

8.4.2 Dewatering Withdrawal Modeling – Analytical Model

An analytical model can be used initially to determine estimated withdrawal rates from a proposed Dewatering Well or multiple Dewatering Wells. The analytical model can be used to estimate volumetric flow using site specific or published values for hydraulic conductivity and hydraulic gradient. If at any-time new information is obtained, or the area to be dewatered changes, resulting in a dewatering estimate that exceeds 100,000 gallons per day, then a numerical model is required.

An analytical model report will require the following information to be supplied to DOEE:

1. Conceptual Site Model in plan-view;
2. Name and Qualifications of the Environmental Professional Conducting the Model. It is required that a licensed or certified geologist or engineer conduct or directly supervise the modeling;
3. Model Information;
4. Model Name and developer;
5. Type of Model;
6. Intended Model Use and Applications;
7. Model Limitations;
8. Model Input Parameters and Assumptions;
9. Reference Input Parameter Sources;
10. Model Output;
11. Withdrawal rates required in units of gallons per minute as an average; and
12. Dewatering zone of influence superimposed on plan-view site map with estimated drawdown contours is required.

8.5 Well Construction Requirements

8.5.1 Applicability Standards

Per Well Regulation §1801, a Well Permit Applicant shall review the Well Guidance Document and the Well Regulations in order to determine the applicability of their well-related activities under the regulations and how to proceed with the well permitting process.

According to the Well Regulations §1801.2:

"A person shall not construct, maintain, or abandon a well in a manner that may create a point source or non-point source of pollutants to waters of the District, impair the beneficial uses of waters of the District, or pose a hazard to public health and safety or the environment."

To comply, the Well Owner has to ensure that, where applicable:

Well construction is in accordance with §§ 1809 through 1826;

- -The use and maintenance is conducted in accordance with §§ 1827 through 1829; and
- -The abandonment of the well is conducted in accordance with §§ 1830 through 1831.

DOEE has developed a series of forms, schematics and flow charts aimed to facilitate the applicants to comply with the standards.

8.5.2 Use of Well Drillers in the District

Per Well Regulation §1808, no person shall construct, maintain, or abandon a well within the District unless that person is a licensed well driller and possesses a current Department of Consumer and Regulatory Affairs business license. All the well activities requiring the use of a drilling rig (drilling, construction, maintenance, and abandonment), require the supervision of a licensed well driller. While the District has not yet implemented a drillers' certification program, driller's licenses from other states are acceptable.

A licensed well driller shall not be required for the construction of a well using hand operated or hand driven tools, such as: hand-augers, soil probes, and hand shovels. In these instances, DOEE expects that the well will not encounter groundwater. Licensed well drillers are required for their professional training and expertise on how to conduct work in the presence of an easily impacted resource while protecting it and following permits and applicable laws and regulations. Well construction also is more involved than just the creation of a borehole with hand-operated or hand-driven tools. The knowledge and ability to implement appropriate materials and methods cannot be reasonably expected of someone without the appropriate professional background. Therefore, if a person anticipates or intends to encounter groundwater using hand-operated or hand-driven tools to construct a well, a licensed well driller should be employed to ensure that well construction is constructed in accordance with District laws, regulations and any issued permits.

A licensed well driller shall not be required for the maintenance of a well, provided that the maintenance does not require the application of chemical treatment, the maintenance of an installed pump, or a material change in the original permitted design, specification, or construction of the well. A licensed well driller is required for the installation of a new piece of equipment, such as a pump, especially if a pump was not previously installed in the well.

8.5.3 Well Construction – Unacceptable Drilling Methods

Drilling methods for well installation that cannot advance temporary (or permanent) outer-casing during drilling or are subject to collapsing borehole are considered unacceptable when any one of the following conditions is present:

- sites where known contamination or Recognized Environmental Conditions are present;
- wells that penetrate perched water or the groundwater table; and
- wells with strong upward vertical gradients (artesian flow); or

- wells where soils are not cohesive.

Examples of drilling methods that are not recommended for some types of these conditions are the bucket auger drilling method and well jetting (EPA, 1993). Neither method can advance casing nor meet the regulatory requirements for proper well construction.

8.5.4 Well Construction – Acceptable Drilling Methods

Regarding acceptable drilling methods for well construction, maintenance, and abandonment activities, the Well Permit Applicant maintains the responsibility to provide a complete Well Construction Work Plan including the proposed drilling method that is based on site specific conditions. This includes site specific conditions of known contamination or Recognized Environmental Conditions, depth to groundwater or perched water zones, and soil cohesiveness.

DOEE reserves the right to make determinations regarding the acceptable drilling methods.

8.5.5 Well Construction – Use of Drilling Fluids

Per Well Regulation §1814, regarding the use of drilling fluids for well construction, maintenance and abandonment activities:

All the drilling fluids to be used in the district shall use only potable water to create a water-based drilling fluid and; the use of additives should be approved by DOEE in the well construction permit application by demonstrating that the additive does not pose a hazard to public health, environment and safety.

8.5.6 Well Construction – General

Additionally to the well construction requirements, from the well regulations §1809, a Well Owner of a well pit, sump pit, or other similar structure installed or constructed below ground surface that can withdraw groundwater or otherwise impact the water resources of the District shall ensure that the well is constructed, used, maintained and abandoned in a manner that shall not impair the beneficial and designated uses of the Waters of the District.

The Well Owner of a well pit, sump pit, or other similar structures installed or constructed below ground surface that can withdraw groundwater or otherwise impact the water resources of the District, shall report the amount of water withdrawn as result of the operation of the well. Any potential, obvious, or known pollution that could discharge through the sump should be reported to DOEE every day, while the withdrawal is conducted. The reporting requirement includes post construction dewatering data.

A Well Owner is required to install temporary or permanent outer casing during well construction to prevent aquifer cross-contamination at a contaminated site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, a Well Owner is required to install temporary outer casing when the drilling method (e.g., direct mud-rotary drilling) does not include dual casing and drilling fluids are used to create the borehole.

Appendix B contains a decision tree for well construction at uncontaminated or contaminated fill/alluvium and at well sites in the Potomac Group. Use of temporary or permanent outer casing

in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Contaminated deeper aquifers under confining pressure (resulting in upward vertical gradients) that are penetrated during drilling require adherence to specific protocols. A permanent outer casing should terminate in a confining unit above the contaminated zone. This casing will be grouted with neat cement and allowed to set prior to advancing the borehole into the contaminated zone. The outer casing will maximize chances of controlling artesian flow; contain the flow within a casing if drilling fluid weight is insufficient to overcome the pressure of the flow; and stabilize the soil around the wellhead. Management of contaminated derived waste (cuttings and fluids) then becomes a requirement. The use of a down-hole packer or water-tight well cap may be required if artesian flow occurs to minimize the volume of contaminated water discharging from the well.

The annual space between the outer casing and well casing should be grouted also with neat cement. Bentonite slurry grouts have little ability to resist axial forces that can displace the grout seal in artesian flow, making bentonite grouts unsuitable for high hydraulic gradient sealing locations where strength is important.

8.5.7 Well Construction – Geology

The geology of a site can complicate the design of dewatering wells. Geological factors can produce aquifers that are anisotropic. In an anisotropic aquifer, groundwater moves faster in one direction than another and oblique to the hydraulic gradient. Anisotropy can result from various sedimentary or structural features such as buried channels, bedding planes, folds, faults, and fractures. In The District of Columbia, most of groundwater flow is either through fractured rocks from the Piedmont or granular materials from sedimentary rocks belonging to the Coastal Plain. Fracture flow in Piedmont bedrock requires additional considerations compared to flow in unconsolidated materials from the Coastal Plain.

Bedrock may exhibit small effective porosities and low hydraulic conductivities that impede groundwater flow. However, its secondary porosity may allow substantial flow of groundwater through fractures, joints, cleavage planes and foliations. These features tend to be highly directional, exhibit varying degrees of interconnection, and may produce local groundwater flow regimes that can be different from the regional trends. The sedimentary bedding planes and distribution and nature of the Coastal Plain also have significant effect on groundwater flow, presenting a series of aquifers and aquitards at different depths. The recent sedimentary deposits (alluvium, artificial sill and fluvial terraces) and the weathered bedrock (Saprolite) conform most of the District unconfined aquifer including perched groundwater conditions in the Coastal Plain area of the District. It is important to understand the characteristics of the Hydrogeologic System of DC before designing any dewatering program and dewatering wells.

8.5.8 Well Construction – Siting

Per Well Regulation §1810, the wells drilled and constructed have to be accessible for maintenance, inspection and abandonment and not be constructed within or under any building,

A utility clearance study is needed to located utility lines and also a search or investigation to identify any pre-existing subsurface structures (tunnels, diversion sewers, metro, etc.).

If the well is sited within the one hundred (100)-year floodplain or any other area prone to flooding, the top of the well head has to be at least twenty-four (24) inches above the finished grade and fully protected from surface water intrusion (§1820.2).

A well shall be located a minimum of twenty-five feet (25 ft) of the higher watermark of any water body of the District or wetland.

8.5.9 Well Construction – Well Relocation

Per Well Regulation §1811, the relocation of a well during construction for the avoidance of utility lines and other obstacles can be done if the relocation is not more than ten feet (10) from the approved location and belongs to the same lot and square number and if drilled, the unsuccessful well has been properly abandoned in accordance with the requirements of the well regulations.

Well setback distances required in the Well Regulations must be maintained.

8.5.10 Well Construction – DOEE Schematics and forms

To facilitate permit applications for dewatering wells construction in the District, DOEE has developed several well schematics for wells in bedrock and in confining units and also developed schematics for supply wells. For dewatering wells, the Applicant can use either the general well schematics and/or the supply well schematics. The DOEE Well Schematics are based on the Well Regulations requirements, and are to serve as a template with fillable spaces to indicate the Well Owner particular well design details to comply with the Well Regulations. The Schematics to use for Dewatering are presented in figures ?? and ??.

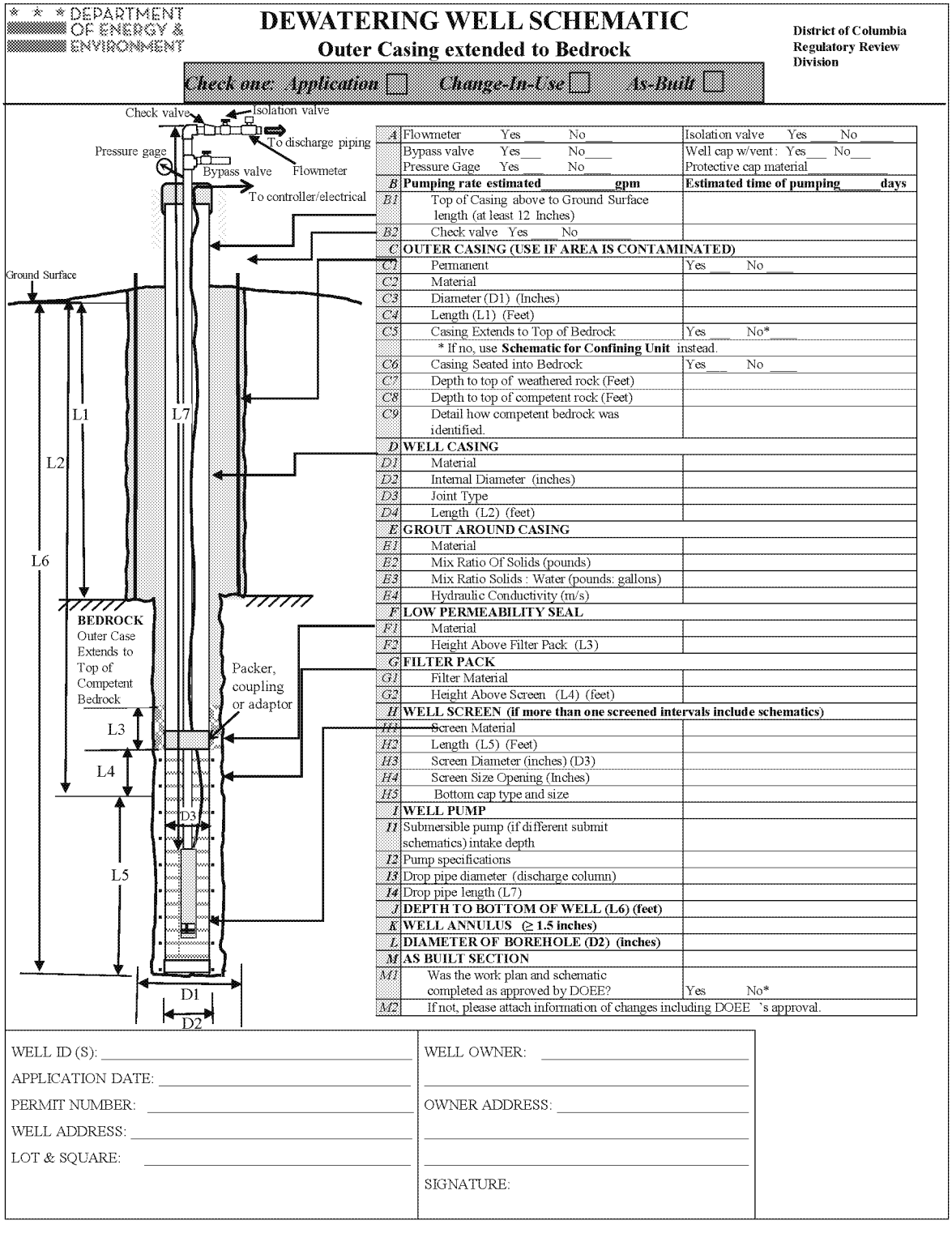


Figure 32. Dewatering well installed in bedrock

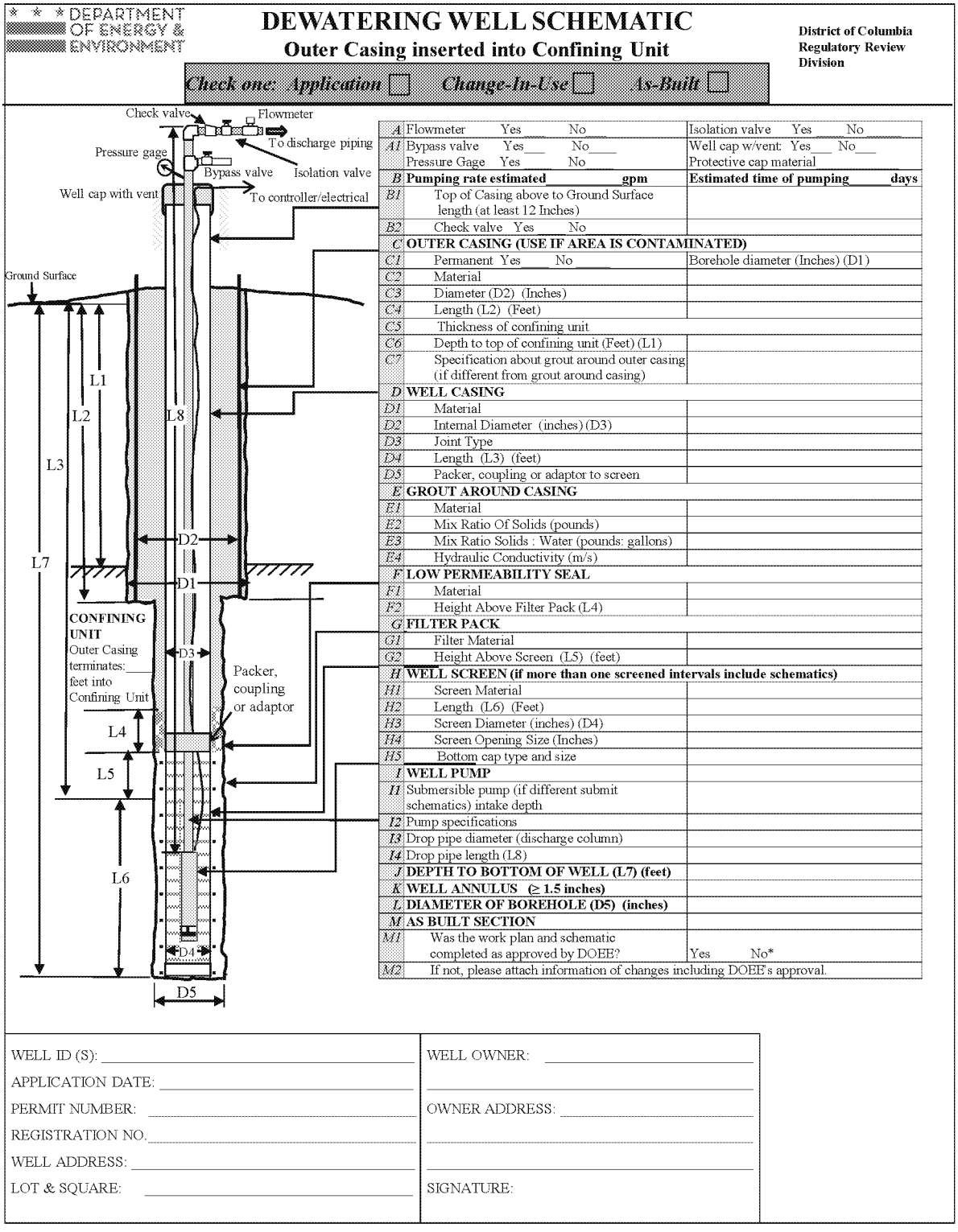


Figure 33. Dewatering Well installed into confining unit

8.5.11 Well Construction – Sanitary Protection

Per Well Regulation §1812, Sanitary protection has to be properly installed for each well and conduct protective measures during the well construction to protect the well and any water-bearing formation against contaminants from any source and surface water drainage.

If contaminants not addressed in the well construction permit are found during the drilling, the responsible of the well should stop the well construction, notify DOEE and follow the procedure described in the Well Regulations.

8.5.12 Well Construction – Well Casing

Per Well Regulation §1815, the well materials, fittings, and equipment, must be appropriate, and approved by the American Society for Testing and Materials (ASTM), the American Water Works Association (AWWA), or the (National Sanitarium Foundation) NSF International and do not poses a hazard to public health and Safety. Additional details can be found in the Well Regulations.

8.5.13 Well Construction – Well Screens

Per Well Regulation §1816, the well screens installed in wells should not extends across more than one aquifer and shall be installed in a way that prevent the cross-contamination of aquifers, the materials shall have sufficient strength and the design shall be appropriate to the aquifer materials.

8.5.14 Well Construction – Filter Pack in Well

Per Well Regulation §1817, the filter pack of a well should be clean and free of toxic materials and substances and the design should be appropriate to the aquifer materials encountered. The responsible of the well design and construction shall be familiar with the restrictions and exemptions from the well regulations.

8.5.15 Well Construction – Well Grouting

This section includes grouting for well construction and the requirements for the low permeability seal in a well.

Grouting Administrative Procedures (Per Well Regulation §1818)

A request may be made to DOEE in accordance with §1803.10 and §1803.11 to deviate from the grouting standards of the Well Regulations, provided the deviation does not result in a less protective standards than those set forth in The Well Regulations.

DOEE may impose additional requirements pertaining to the grouting of a well in the well construction permit to ensure the protection of public health and safety and the environment.

When structural stability is a concern in the subsurface, the applicant may request the use of cement based grout as bentonite may be an unsuitable material. An example of when this situation may arise is when a borehole is made through a road base or underneath an earthwork or other structure that could collapse if cement is not used.

In addition to the Well Regulations §1818 (specifications regarding grouting), a sodium-based bentonite grout should be fully hydrated in accordance with the manufacturer's specifications. Over hydration can lead to slumping and cracking when the grout begins to dry out above the saturated zone. The choice between a pure sodium-based bentonite grout and a sodium-based bentonite-cement mixture that is predominantly composed of cement is dependent on the intended use of the grout and site conditions.

A pure bentonite slurry grout is suitable below the saturated zone but will tend to dry out and crack in the unsaturated zone. This material typically should be used for a well screened in the saturated zone but not extending up through the unsaturated zone.

DOEE recognizes that in parts of the District the confining unit may be much thinner (e.g., five feet thick). If this situation exists at the site and the confining unit is laterally continuous below a contaminated zone, and can be reasonably expected to prevent the spread of contamination within an aquifer, DOEE will allow a smaller penetration into the thinner clay to provide protection from the vertical migration of contaminants. The need for this adjustment or a similar one will be evaluated on a case-by-case basis.

As the confining unit becomes thinner, it may be more practical to install a bentonite seal to act as a protective seal to prevent the vertical spread of contamination.

All grout materials placed in the borehole must be free of contaminants.

Note: An applicant is required to submit the Safety Data Sheet of a non-silica based material to be placed in a borehole to DOEE for review and approval.

8.5.16 Well Construction – Well Development

DOEE expects that a properly designed, constructed, and developed well in a non-fill area will be able to easily attain a turbidity level of 10 NTUs. As in-situ fine-grained sediments in fill areas may present development challenges, the regulation allows well development to be completed if all field parameter values stabilize, turbidity values do not exceed 20 NTUs; and the pH, specific conductivity, temperature, and turbidity of the water recovered from the well are determined to be within a ten percent (10%) range and considered at equilibrium.

8.5.17 Well Construction – Well Caps & Upper Terminus of Well

Per Well Regulation §1820, except as provided in §1820.3 and §1820.4, the upper terminus of a dewatering well shall meet the requirements of the Well Regulations (covered with a secure and locking cap and constructed to prevent the introduction of contaminants including a vented capping device) unless otherwise approved in writing by DOEE in accordance with §1803.10 and §1803.11.

8.5.18 Well Construction – Well Labeling

Per Well Regulation §1821, a well registration number issued by DOEE in accordance with §1806 must be attached or labeled at a visible location to the terminal surface of a well.

A dewatering well constructed for temporary construction applications does not require a well registration label, provided that the well is sited within a secured perimeter no accessible to the

public; the well completion details are maintained on site; and the well is abandoned within 180 days of well completion.

8.6 Well Use and Maintenance Requirements

8.6.1 Well Maintenance Requirements

Per Well Regulation §1827, the well maintenance is mandatory.

Well maintenance typically is performed to avoid impairment of the groundwater; prevent corrosion and safety hazards; address limitations in well use due to clogging of the well screen or water intake; and lower turbidity levels.

Well maintenance is strongly recommended by DOEE to be performed using physical methods such as, scrubbing and well redevelopment prior to the use of chemical treatment. Mild chemical treatment with minimal impact to groundwater and well structural integrity shall be applied and the results shown to be ineffective before a well owner may propose the use of harsh or strong chemicals.

DOEE expects that no wells are maintained through the application of chemical treatment except in accordance with a well maintenance work plan reviewed and approved by DOEE.

A well maintenance work plan involving chemical treatment will include:

- details of the well;
- the maintenance problem and supporting documentation such as, changes in water level data, water yield data, water chemistry data, color, taste, or odor;
- downhole video camera inspection findings;
- photographs;
- details and results of physical methods used to clean the well screen and any equipment such as, pumps and lines;
- the proposed action including the products to be used, the treatment process and endpoints, duration of treatment, the expected impact on the waters of the District during treatment, and how the impact will be minimized and reversed;
- SDS and manufacturer's specifications for proposed chemical products;
- sampling protocols during treatment, monitoring locations, sampling frequency, analytes to be sampled, and USEPA-approved laboratory methods with appropriate detection and reporting limits that will be used;
- data Quality Assurance and Quality Controls;
- laboratory NELAC certification;
- well driller's license and business license to operate in the District of Columbia;
- copy of the current well permit and registration;
- information about solid and effluent disposal including the effluent discharge location and treatment prior to discharge, if applicable;

- a map or figure showing the location of the well, site features, property lines, nearest street intersection, scale bar and north arrow;
- proposed treatment schedule; and
- any other details.

Within sixty (60) days of work completed in accordance with § 1827.4, the Well Owner will submit to DOEE a report detailing the work that was performed with supporting documentation.

DOEE is expecting that the well maintenance is not significantly depleting or degrading groundwater resources or significantly interfering with groundwater recharge. Significant depletion of groundwater resources includes a long-term reduction or loss of natural artesian pressure, decline in the groundwater table, or reduced baseflow to a stream. Reduced groundwater discharge to a stream (i.e., baseflow) also will likely lead to stream degradation and adverse effects on aquatic life.

8.6.2 Well Use Requirements

A supply, dewatering or recovery Well Owner proposing to increase groundwater withdrawal must present the request with supporting documentation including projected impacts on the aquifer to DOEE for review and approval, since the modification of depletion rate is a modification change to the existing permit according to §1804.6.

Permanent or long-term withdrawal within a groundwater recharge area is not recommended as it may prevent or limit groundwater recharge in an aquifer. A well Permit Applicant proposing to site a supply well in such as location has to demonstrate to DOEE's satisfaction that likely detrimental effects on the aquifer, such as a long term decline in the available resource, subsidence, changes in water chemistry, saltwater intrusion, reduced baseflow to streams, etc. will not occur.

The discharge of fluids withdrawn from a well to a separate storm water sewer or waters of the District that may cause a violation of the District Water Quality Standards in Chapter 11 of Title 21 of the District of Columbia Municipal Regulations (DCMR), result in acute or chronic exposure to aquatic biota, or pose a hazard to the public health and safety or the environment, is not allowed without obtaining applicable District and federal permits.

An owner of a well that is used for permanent dewatering at an uncontaminated site must report to DOEE if any contaminants are suspected or identified in the effluent discharge.

8.7 Well Abandonment Requirements

8.7.1 8.7.1Well Abandonment – General

Additionally to Well Regulation §1830, a dewatering well must be permanently abandoned in accordance with the requirements of the Well Regulations as soon as the dewatering period ends, but no later than seven (7) calendar days following the termination of pumping.

A dewatering well provides an easy vertical migration pathway for contaminants especially when the well is screened across multiple aquifers. A dewatering well must be properly abandoned and

not left to be included in the general excavation at a construction site or worse, have the casing cut off and the foundation poured over the remains of the well. This pathway must be quickly, effectively and permanently sealed to protect the groundwater resource.

The regulation requires a dewatering Well Owner to immediately begin abandonment of the dewatering well when the pump is turned off. As a dewatering well may be quite deep and strong upward hydraulic gradients may pose difficulties during well abandonment, DOEE expects that site conditions will be taken into consideration during the abandonment work plan development so that contingency plans can be in place prior to the commencement of field activities.

At no time should the Well Owner assume that DOEE will approve abandonment in place. Planning involving good well design and well location selection before the well is constructed will prevent concerns about the well casing breaking during removal and access not being possible after the dewatering phase is completed. If all else fails, DOEE expects the Well Owner to have the old well overdrilled and grouted appropriately as part of the well abandonment process. Only under exceptional circumstances will the seven-day abandonment deadline be extended.

If additional time is required to abandon a well a request may be submitted to DOEE in accordance with §1803.10 and §1803.11.

8.7.2 Well Abandonment – Procedures

The accepted well abandonment procedures in the District are listed in Well Regulation §1831. The Well Abandonment Application form and the Well Abandonment Report are included in appendix B.

The abandonment design should be site specific, and based on existing conditions and expected future site use.

Fill materials - These materials can be used for very large diameter boreholes, such as old supply wells where abandonment using only bentonite grout could result in structural problems. The applicant must satisfy DOEE that the fill materials are naturally-occurring, inert, certified clean, and organic-free from an uncontaminated site. The applicant should provide independent sampling and analysis to verify that use of the soil will not result in an elevation of inorganic constituent concentrations above site background values. Issues to consider and general practices that may be followed are presented in the California Department of Environmental Protection publication entitled Information Advisory - Clean Imported Fill Material dated October 2001 https://www.dtsc.ca.gov/Schools/upload/SMP_FS_Cleanfill-Schools.pdf).

Appropriate use of clean fill materials - If a Well Owner wishes to abandon such a large-diameter well, it is a relatively straightforward process and this process showed be clearly provided in the abandonment work plan. Based on site conditions, some variations may be necessary, but the general procedure involves removal of obstructions that would interfere with proper well abandonment around and inside the well and placement of alternating layers of bentonite grout and clean fill. These actions are followed by removal of the uppermost three feet of casing or curbing used to keep the well open and installing a final cap. An acceptable plugging procedure for sealing a hand-dug water well consists of the following sequence:

1. Place a one-foot layer of bentonite chips in the bottom of the water well.

2. Place a five-foot layer of sand or other clean fill material above the bentonite.
3. Cover with another one-foot layer of bentonite chips.
4. Repeat the layering sequence to about three feet below grade with the last layer being a six-inch layer of bentonite chips.
5. Remove the curbing or casing from three feet below grade to the surface.
6. Fill the remaining hole with one foot of cement followed by topsoil fill.
7. Shape the topsoil fill to create a crown that directs surface water away from the water well site or neatly place materials on top of the old well to match the existing surface cover.

8.8 Special Conditions – Grouting and Sealing

Refer to Section 13 of this Well Guidance Document for general standards and procedures for grouting wells during construction and for sealing wells during abandonment and in order to potentially prevent the introduction and/or migration of contaminants.

8.9 Special Conditions – Contaminated Sites

Refer to Section 14 of this Well Guidance Document for detailed information and the requirements for contaminated sites.

8.10 Special Conditions – Derived Material Management

Refer to Section 15 of this Well Guidance Document for detailed information and the requirements for derived material management.

8.11 Special Conditions – Decontamination

Refer to Section 16 of this Well Guidance Document for detailed information and the requirements for decontamination.

8.12 Special Conditions – Geologic and Hydrogeologic Environment

Refer to Section 17 of this Well Guidance Document for supplemental information regarding the geologic and hydrogeologic environmental of the District.

Chapter 9 Injection Well Requirements

9.1 Definitions

- Well – any test hole, shaft, or soil excavation created by any means including, but not limited to, drilling, coring, boring, washing, driving, digging, or jetting, for purposes including, but not limited to, locating, testing, diverting, artificially recharging, or withdrawing fluids, or for the purpose of underground injection. [Statutory]
- Injection Well – a well through which liquid or gas is injected, under pressure or gravity flow, into the subsurface for the purpose of maintaining formation pressure, recharging the aquifer, or the treatment of contaminants.

9.2 Applicable Forms, Work Plans, and Supplemental Guidance Documents

Provided below is a list of applicable forms, work plans and supplemental guidance documents over the life cycle of a well. The applicability of these documents may vary based on the specific requirements and site conditions for the well construction, maintenance, and abandonment activities. Refer to Section 1.5 of this Well Guidance Document for more detailed information.

- Well Construction Permit Application/Registration Form
- Well Construction Completion Form
- Well Development Log Form
- Well Pumping Test Application Form
- Well Additional Geographic Data Form
- Well Abandonment Application Form
- Well Abandonment Form
- Well Registration Form/Completion Form (applicable for a well permitted before the Well Regulations were promulgated)
- Well Change-In-Use Form
- Well Change-in-Ownership Form
- Well Construction Work Plan
- DC Map of Known Wetlands and Waterbodies
- Hydraulic Conductivity Chart of Borehole Sealants
- District of Columbia Geologic Map
- Well Schematic Flush-Mounted Wells-Bedrock

- Well Schematic Flush-Mounted Wells-Confining Unit
- Stick-up Schematic-Bedrock
- Stick-up Schematic-Confining Unit
- Multiple Well-Boring Data Collection Sheet
- Grouting Calculation of Bentonite-Cement-Water Ratios

DOEE has prepared a list of instructions for each Form and Spreadsheet to assist applicants with their completion.

9.3 Injection Wells Objectives

According to the EPA Underground Injection Control (UIC), an injection well is used to place fluid underground into porous geologic formations. These underground formations may range from deep sandstone or limestone, to a shallow soil layer. Injected fluids may include water, wastewater, brine (salt water), or water mixed with chemicals. The Well Regulation Regulations definition narrows the type of injection wells more likely to exist in the District to: wells used for maintaining formation pressure, recharging the aquifer, or the treatment of contaminants.

District of Columbia's groundwater is a critical resource that provides environmental benefits and contributes to the well-being of the citizens of the District and, in specific cases, a source of water.

Adequate protection of the District's groundwater requires that the installation of injection wells comply with the Well Regulations. This chapter is intended to provide guidance on implementation of the Wells Regulations for injection wells.

Injection wells must be designed, located, and constructed to accomplish their goal and also ensure that: injected fluids stay within the well and the intended injection zone and; fluids that are directly or indirectly injected into an aquifer do not cause a change in the water quality to exceed the District's Water Quality Standards or otherwise adversely affect public health.

9.4 Well Construction Requirements

9.4.1 Applicability Standards

Per Well Regulation §1801, Injection Wells Well Permit Applicants shall review the Well Guidance Document and the Well Regulations to determine the applicability of their well-related activities under the regulations and how to proceed with the well permitting process.

According to the Well Regulations 1801.2:

"A person shall not construct, maintain, or abandon a well in a manner that may create a point source or non-point source of pollutants to waters of the District, impair the beneficial uses of waters of the District, or pose a hazard to public health and safety or the environment."

"…A well owner shall obtain an EPA Underground Injection Control Permit or an exemption from such permit for the injection of a substance into a well or an injection system within the District."

To comply, the well owner has to ensure that, where applicable:

- Well construction is in accordance with §§ 1809 through 1826;
- The use and maintenance is conducted in accordance with §§ 1827 through 1829; and
- The abandonment of the well is conducted in accordance with §§ 1830 through 1831.

DOEE has developed a series of forms, schematics, and flow charts to help applicants comply with the standards.

9.4.2 Use of Well Drillers in the District

Per Well Regulation §1808, no person shall construct, maintain, or abandon a well within the District unless that person is a licensed well driller and possesses a current Department of Consumer and Regulatory Affairs business license.

All well activities requiring the use of a drilling rig (drilling, construction, maintenance, and abandonment) require the supervision of a licensed well driller. While the District has not implemented yet a Drillers' certification program, other states Driller licenses are acceptable.

9.4.3 Well Construction – Unacceptable Drilling Methods

Drilling methods for well installation that cannot advance temporary and permanent outer-casing during drilling or are subject to collapsing borehole are considered unacceptable when any one of the following conditions are present:

a. sites where known contamination or Recognized Environmental Conditions are present;
b. wells that penetrate perched water or the groundwater table,
c. wells with strong upward vertical gradients (artesian flow), or,
d. wells where soils are not cohesive.

Examples of drilling methods that are not recommended for some types of these conditions are the bucket auger drilling method and well jetting (EPA, 1993). Neither method can advance casing nor meet the regulatory requirements for proper well construction.

9.4.4 Well Construction – Acceptable Drilling Methods

Regarding acceptable drilling methods for well construction, maintenance, and abandonment activities, the Well Permit Applicant maintains the responsibility to provide a complete Well Construction Work Plan including the proposed drilling method that is based on site specific conditions. This includes site specific conditions of known contamination or Recognized Environmental Conditions, depth to groundwater or perched water zones, and soil cohesiveness.

DOEE reserves the right to make determinations regarding the acceptable drilling methods.

9.4.5 Well Construction – Use of Drilling Fluids

Per Well Regulation §1814, regarding the use of drilling fluids for well construction, maintenance, and abandonment activities:

All the drilling fluids to be used in the district shall use only potable water to create a water-based drilling fluid and; the use of additives should be approved by DOEE in the well construction permit application by demonstrating that the additive does not pose a hazard to public health, environment and safety.

9.4.6 Well Construction – General

Additionally to the well construction requirements from the well regulations §1809, a Well Owner is required to install temporary and/or permanent outer casing during well construction to prevent aquifer cross-contamination at a contaminated site. The use of Temporary and/or Permanent Outer Casing shall be determined based upon the type of contamination and where it is found vertically and horizontally at a site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, a Well Owner is required to install temporary outer casing when the drilling method (e.g., direct mud-rotary drilling) does not include dual casing and drilling fluids are used to create the borehole.

Appendix B contains a decision tree for well construction at uncontaminated or contaminated fill/alluvium and at well sites in the Potomac Group. Use of temporary or permanent outer casing in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Contaminated deeper aquifers under confining pressure (resulting in upward vertical gradients) that are penetrated during drilling require adherence to specific protocols. A permanent outer casing should terminate in a confining unit above the contaminated zone. This casing will be grouted and allowed to set prior to advancing the borehole into the contaminated zone. The outer casing will maximize chances of controlling artesian flow; contain the flow within a casing if drilling fluid weight is insufficient to overcome the pressure of the flow; and stabilize the soil around the wellhead. Management of contaminated derived waste (e.g., cuttings and fluids) then becomes a requirement. The use of a down-hole packer or water-tight well cap may be required if artesian flow occurs to minimize the volume of contaminated water discharging from the well.

The annular space between the outer casing and well casing should be grouted. Bentonite slurry grouts have little ability to resist axial forces that can displace the grout seal in artesian flow, making bentonite grouts unsuitable for high hydraulic gradient sealing locations where strength is important. Bentonite chips or a mixture of bentonite and cement can be used depending on site conditions.

9.4.7 Well Construction – Geology

The geology of a site can complicate the selection of the target zones for injection. Geological factors can produce aquifers that are anisotropic. In an anisotropic aquifer, groundwater moves faster in one direction than another and oblique to the hydraulic gradient. Anisotropy can result from various sedimentary or structural features such as buried channels, bedding planes, folds, faults, and fractures. In The District of Columbia, most of groundwater flow is either through fractured rocks from the Piedmont or granular materials from sedimentary rocks belonging to the

Coastal Plain. Fracture flow in Piedmont bedrock requires additional considerations compared to flow in unconsolidated materials from the Coastal Plain.

Bedrock may exhibit small effective porosities and low hydraulic conductivities that impede groundwater flow. However, its secondary porosity may allow substantial flow of groundwater through fractures, joints, cleavage planes and foliations. These features tend to be highly directional, exhibit varying degrees of interconnection, and may produce local groundwater flow regimes that can be different from the regional trends. The sedimentary bedding planes and distribution and nature of the Coastal Plain also have significant effect on groundwater flow, presenting a series of aquifers and aquitards at different depths. The recent sedimentary deposits (alluvium, artificial sill and fluvial terraces) and the weathered bedrock (Saprolite) conform most of the District unconfined aquifer including perched groundwater conditions in the Coastal Plain area of the District. It is important to understand the characteristics of the Hydrogeologic System of DC before designing any injection well.

9.4.8 Well Construction – Siting

Per Well Regulation §1810, the wells drilled and constructed have to be accessible for maintenance, inspection and abandonment and not be constructed within or under any building,

A utility clearance study is needed to located utility lines and also a search or investigation to identify any pre-existing subsurface structures (tunnels, diversion sewers, metro, etc.).

If the well is sited within the one hundred (100)-year floodplain or any other area prone to flooding, the top of the well head has to be is at least twenty-four (24) inches above the finished grade and fully protected from surface water intrusion (§1820.2).

A well shall be located a minimum of twenty-five feet (25 ft) of the higher watermark of any water body of the District or wetland.

9.4.9 Well Construction – Well Relocation

Per Well Regulation §1811, the relocation of a well during construction for the avoidance of utility lines and other obstacles can be done if the relocation is not more than ten feet (10) from the approved location and belongs to the same lot and square number and if drilled, the unsuccessful well has been properly abandoned in accordance with the requirements of the well regulations. Well setback distances required in the Well Regulation are maintained.

9.4.10 Well Construction – DOEE Schematics and forms

To facilitate permit applications for wells construction in the District, DOEE has developed several well schematics for wells in bedrock and in confining units. For injection wells, the Applicant can use either the general well schematics. The DOEE Well Schematics are based on the Well Regulation requirements, and are to serve as a template with fillable spaces to indicate the Well Owner particular well design details to comply with the Well Regulations. The Schematics to use for Dewatering are presented in figures 5, 6, 7, 8, 11 and 12.

9.4.11 Well Construction – Sanitary Protection

Per Well Regulation §1812, Sanitary protection has to be properly installed for each well and conduct protective measures during the well construction to protect the well and any water-bearing formation against contaminants from any source and surface water drainage.

If contaminants not addressed in the well construction permit are found during the drilling, the responsible of the well should stop the well construction, notify DOEE and follow the procedure described in the well regulations.

9.4.12 Well Construction – Well Casing

Per Well Regulation §1815, the well materials, fittings, and equipment, must be appropriate, and approved by the American Society for Testing and Materials (ASTM), the American Water Works Association (AWWA), or the (National Sanitarium Foundation) NSF International and do not poses a hazard to public health and Safety. Additional details can be found in the well regulations.

9.4.13 Well Construction – Well Screens

Per Well Regulation §1816, the well screens installed in wells should not extend across more than one aquifer and installed in a way that prevent the cross-contamination of aquifers, the materials shall have sufficient strength and the design shall be appropriate to the aquifer materials.

9.4.14 Well Construction – Filter Pack in Well

Per Well Regulation §1817, the filter pack of a well should be clean and free of toxic materials and substances and the design should be appropriate to the aquifer materials encountered. The responsible of the well design and construction shall be familiar with the restrictions and exemptions from the well regulations.

9.4.15 Well Construction – Well Grouting

Per Grouting Administrative Procedures (Per Well Regulation §1818), A request may be made to DOEE in accordance with §1803.10 and §1803.11 to deviate from the grouting standards of the Well Regulations, provided the deviation does not result in a less protective standards than those set forth in the regulations Section.

DOEE may impose additional requirements pertaining to the grouting of a well in the well construction permit to ensure the protection of public health and safety and the environment. In addition to §1818 specifications regarding grouting, a sodium-based bentonite grout should be fully hydrated in accordance with the manufacturer's specifications. Over hydration can lead to slumping and cracking when the grout begins to dry out above the saturated zone. The choice between a pure sodium-based bentonite grout and a sodium-based bentonite-cement mixture that is predominantly composed of cement is dependent on the intended use of the grout and site conditions.

A pure bentonite slurry grout is suitable below the saturated zone but will tend to dry out and crack in the unsaturated zone. This material typically should be used for a well screened in the

saturated zone but extending up through the unsaturated zone a bentonite-cement grout should be used according to the regulations.

9.4.16 Well Construction – Well Development

In addition to Well Regulation §1819, DOEE expects that a properly designed, constructed and developed well in a non-fill area will be able to easily attain a turbidity level of 10 NTUs. As in-situ fine-grained sediments in fill areas may present development challenges, the regulation allows well development to be completed if all field parameter values stabilize and turbidity values do not exceed 20 NTUs. However, for a monitoring well, the turbidity level must stabilize at 5 NTUs, and the pH, specific conductivity, temperature, and turbidity of the water recovered from the well, are determined to be within a ten percent (10%) range and considered at equilibrium.

9.4.17 Well Construction – Well Caps & Upper Terminus of Well

Per Well Regulation §1820, the upper terminus of a well shall meet the requirements of the regulations, unless otherwise approved in writing by DOEE.

9.4.18 Well Construction – Well Labeling

Per Well Regulation §1821, a well registration number issued by DOEE in accordance with §1806 shall be attached or labeled at a visible location to the terminal surface of a well.

A well registration label shall not be required for a soil boring, monitoring well, observation well, or piezometer, injection well, or recovery well provided the well is abandoned within thirty (30) days of well completion in accordance with the well regulations.

9.5 Well Use and Maintenance Requirements

9.5.1 Well Use and Maintenance – General

Per Well Regulation §1827, the well maintenance is mandatory.

Well maintenance typically is performed to avoid impairment of the groundwater; prevent corrosion and safety hazards; address limitations in well use due to clogging of the well screen or water intake; and lower turbidity levels.

Well maintenance shall be performed using physical methods such as, scrubbing and well redevelopment prior to the use of chemical treatment. Mild chemical treatment with minimal impact to groundwater and well structural integrity shall be applied and the results shown to be ineffective before a well owner may propose the use of harsh or strong chemicals.

A well maintenance work plan involving chemical treatment must include:

- details of the well;
- the maintenance problem and supporting documentation such as, changes in water level data, water yield data, water chemistry data, color, taste, or odor;
- downhole video camera inspection findings;

- photographs;
- details and results of physical methods used to clean the well screen and any equipment such as, pumps and lines;
- the proposed action including the products to be used, the treatment process and endpoints, duration of treatment, the expected impact on the waters of the District during treatment, and how the impact will be minimized and reversed;
- SDS and manufacturer's specifications for proposed chemical products;
- sampling protocols during treatment, monitoring locations, sampling frequency, analytes to be sampled, and USEPA-approved laboratory methods with appropriate detection and reporting limits that will be used;
- data Quality Assurance and Quality Controls;
- laboratory NELAC certification;
- well driller's license and business license to operate in the District of Columbia;
- copy of the current well permit and registration;
- information about solid and effluent disposal including the effluent discharge location and treatment prior to discharge, if applicable;
- a map or figure showing the location of the well, site features, property lines, nearest street intersection, scale bar and north arrow;
- proposed treatment schedule; and
- any other details.

An aquifer should not be used for waste disposal purposes or be significantly degraded by any means including the discharge or infiltration of chemical, biological, or radiological materials or heat. An injection well used for remediation purposes at a DOEE-regulated contamination site is not considered to cause significant degradation if use of the well causes short-term (less than one year) groundwater quality changes that are confined to the Well Owner's property; other pollutants are not released or mobilized at the site at concentrations that exceed the District's Groundwater Quality Standards; and long-term groundwater quality monitoring verifies that these conditions are met. The well owner or Well Permit Applicant or Well Owner proposing to inject material into the subsurface should present the means and methods to achieve these conditions in a detailed work plan for DOEE's review and approval.

9.5.2 Well Use and Maintenance – Injection Well

Per Well Regulation §1829, a Well Owner must obtain written approval from DOEE for the injection of a substance into a well or an injection system within the District, and obtain an EPA Underground Injection Control Permit or an exemption from such permit for the injection of a substance into a well or an injection system within the District.

A Well Owner or a person responsible for injecting a fluid into a well by active or passive means will be responsible for:

1. designing a remediation treatment system that does not result in the development of residual materials that cause an exceedance of the District's Groundwater's Standards;
2. ensuring that the injected material and degradation products, do not remain to cause an impairment of the waters of the District after the manufacturer's specifies that the degradation products should no longer be evident in the environment; and
3. establishing an appropriately sized and located groundwater monitoring network, with quarterly monitoring frequency, for at least one year after the date that the manufacturer specifies that the degradation products should no longer be evident in the environment.
4. The responsible party will demonstrate through groundwater monitoring data and other analyses which maybe requested by DOEE, that these criteria are met before conditional case closure is granted.

At a contaminated site, a responsible party is liable for any exacerbation, or disruption of existing contamination caused by the injection process.

The responsible party is liable for the chemical or biological materials injected and their by-products that may cause a negative impact on the environment.

9.6 Well Abandonment Requirements

9.6.1 Well Abandonment – Procedures

The accepted well abandonment procedures in the District are listed in Well Regulation §1831 are:

- Rip or perforate the well casing below ground surface;

Rip or perforate the casing followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting of the well annulus, or the well annulus was allowed to be backfilled with cuttings. The grout will flow through the openings or perforations to seal any porous zones along the outside of the casing. A minimum of five perforations per linear foot of casing or screen is recommended (American Society for testing Materials, Standard D 5299-99, 2012). After the rip or perforating in complete, the borehole must be grouted according to the procedures listed on chapter 13.5 and the upper 5 feet of borehole restored with suitable materials to create a cover similar to that of the surrounding area, such as concrete, asphalt or native soils or a combination of these materials.

- Over-drill the well casing for removal;

Over-drilling is the abandonment technique used to remove an entire well, its sand or gravel pack and the old grout column and fill. In situations where PVC screens and risers are expected to sever and removal of all well materials is required, over drilling technique is required. Over-drilling is used when a riser cannot be pulled and it penetrates a confining layer. It is a method commonly used for monitoring wells.

A temporary casing may be required when conditions are present such a high concentration of mobile contaminants in the upper layers (fill, alluvium or granular materials), depth to water is shallow or perched aquifer conditions, there is poor construction documentation or bad

construction practices. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling, pulling, grouting within this casing. The casing is recovered at the end of pulling, grouting and drilling. If the confining unit is less than 5 feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of 2 feet below the top of the confining layer. After the outer casing has been set, the well can be removed and grouted through pulling if possible or removed and grouted by drilling inside the casing.

Over-drilling is recommended where casing pulling is determined to be unfeasible, or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled.

As a precaution, the well column should be filled with grout before over-drilling.

Prior to over-drilling, the bottom of the well should be perforated or cut away, and the casing filled with grout.

Over-drilling should advance beyond the original bore depth by a distance of half a foot to ensure complete removal of the construction materials.

- Submit an alternate abandonment procedure to the Department for approval in accordance with §§ 1803.10 and 1803.11.

In any method selected by the applicant, DOEE expects that the abandoned well will be filled and sealed in an effective and permanent manner that prevents vertical fluid migration within the well or the annulus surrounding the well casing.

9.6.2 Well Abandonment – Report

A well Abandonment Report submitted to DOEE must include the following details:

The relevant DC Well Abandonment and/or D.C. Well Construction Completion Forms;

If more than one well/boring was installed or abandoned, use only one Completion or Abandonment form and provide a boring matrix/schedule accounting for all wells and borings installed under the DCRA permit whether or not they were abandoned or still in use. Note on the form that the information is stated on the attached matrix/schedule. The matrix/schedule should provide the following details:

- Well Identification Number;
- Date of completed installation or abandonment;
- Type of well;
- Borehole depth below ground surface;
- Borehole diameter;
- Screened interval, if applicable;
- Geologic Formation or Aquifer the well is screened in (if known);
- Well location coordinates using Maryland State Plane Coordinate System or Latitude and Longitude; and

- Well elevation using NAV83.
- A site map drawn to scale with a north arrow, property lines, building footprints, the nearest street intersection, and the locations of all borings or wells whether or not they were abandoned or still in use;
- A scaled site map with scale bar;
- A north arrow;
- Property lines showing public space;
- Building footprints;
- The nearest street intersection; and
- Locations of all on-site wells/borings including those that were proposed and those to be abandoned.
- Photographs showing the abandonment procedure;
- All the Boring logs generated under the well permit;
- Any additional comments.

9.7 Special Conditions – Grouting and Sealing

Refer to Section 13 of this Well Guidance Document for general standards and procedures for grouting wells during construction and for sealing wells during abandonment and in order to potentially prevent the introduction and/or migration of contaminants.

9.8 Special Conditions – Contaminated Sites

Refer to Section 14 of this Well Guidance Document for detailed information and the requirements for contaminated sites.

9.9 Special Conditions – Derived Material Management

Refer to Section 15 of this Well Guidance Document for detailed information and the requirements for derived material management.

9.10 Special Conditions – Decontamination

Refer to Section 16 of this Well Guidance Document for detailed information and the requirements for decontamination.

9.11 Special Conditions – Geologic and Hydrogeologic Environment

Refer to Section 17 of this Well Guidance Document for supplemental information regarding the geologic and hydrogeologic environmental of the District.

Chapter 10 Recovery Well Requirements

10.1 Definitions

- Well – any test hole, shaft, or soil excavation created by any means including, but not limited to, drilling, coring, boring, washing, driving, digging, or jetting, for purposes including, but not limited to, locating, testing, diverting, artificially recharging, or withdrawing fluids, or for the purpose of underground injection. [Statutory]
- Recovery Well – a well that is used to withdraw groundwater for disposal or treatment of contaminants contained within the groundwater.

10.2 Applicable Forms, Work Plans, and Supplemental Guidance Documents

Provided below is a list of applicable forms, work plans and supplemental guidance documents over the life cycle of a well. The applicability of these documents may vary based on the specific requirements and site conditions for the well construction, maintenance, and abandonment activities. Refer to Section 1.5 of this Well Guidance Document for more detailed information.

- Well Construction Permit Application/Registration Form
- Well Construction Completion Form
- Well Development Log Form
- Well Pumping Test Application Form
- Well Additional Geographic Data Form
- Well Abandonment Application Form
- Well Abandonment Form
- Well Registration Form/Completion Form (applicable for a well permitted before the Well Regulations were promulgated)
- Well Change-In-Use Form
- Well Change-in-Ownership Form
- Well Construction Work Plan
- DC Map of Known Wetlands and Waterbodies
- Hydraulic Conductivity Chart of Borehole Sealants
- District of Columbia Geologic Map
- Well Schematic Flush-Mounted Wells-Bedrock
- Well Schematic Flush-Mounted Wells-Confining Unit

- Stick-up Schematic-Bedrock
- Stick-up Schematic-Confining Unit
- Multiple Well-Boring Data Collection Sheet
- Grouting Calculation of Bentonite-Cement-Water Ratios

DOEE has prepared a list of instructions for each Form and Spreadsheet to assist applicants with their completion.

10.3 Recovery Wells Objectives

District of Columbia's groundwater is a critical resource that provides environmental benefits and contributes to the well-being of the citizens of the District and, in specific cases, a source of water.

Adequate protection of the District's groundwater requires remediation of the contaminated sites, Recovery Wells are in many cases a key component in remediation technologies aimed to clean up groundwater. This chapter is intended to provide guidance on implementation of the wells regulations for Recovery Wells.

Recovery wells must be located and constructed to be able to recover by pumping or other means contaminants or contaminated water. They must be constructed by an experience driller who is licensed for drilling and installation of Recovery Wells.

10.4 Well Construction Requirements

10.4.1 Applicability Standards

Per Well Regulation §1801, Well Permit Applicants shall review the Well Guidance Document and the Well Regulations to determine the applicability of their well-related activities under the regulations and how to proceed with the well permitting process.

According to the Well Regulation (§ 1801.2):

"A person shall not construct, maintain, or abandon a well in a manner that may create a point source or non-point source of pollutants to waters of the District, impair the beneficial uses of waters of the District, or pose a hazard to public health and safety or the environment."

To comply, the well owner has to ensure that, where applicable:

- Well construction is in accordance with §§ 1809 through 1826;
- The use and maintenance is conducted in accordance with §§ 1827 through 1829; and
- The abandonment of the well is conducted in accordance with §§ 1830 through 1831.

DOEE has developed a series of forms, schematics and flow charts aimed to facilitate the applicants to comply with the standards.

10.4.2 Use of Well Drillers in the District

Per Well Regulation §1808, all the well activities requiring the use of a drilling rig (drilling, construction, maintenance and abandonment), require the supervision of a licensed well driller. While the District has not implemented yet a Drillers' certification program, other states Driller licenses are acceptable.

10.4.3 Well Construction – Unacceptable Drilling Methods

Drilling methods for well installation that cannot advance temporary or permanent outer-casing during drilling (see Section 10.3.10) are considered unacceptable if any of the following conditions apply:

a. A site has known contamination or a Recognized Environmental Condition,

b. the well will penetrate perched groundwater or the groundwater table, or

c. the well will encounter strong upward vertical gradients (artesian flow).

Examples of drilling methods that are not recommended for some types of these conditions are the bucket auger drilling method and well jetting (EPA, 1993). Neither method can advance casing nor meet the regulatory requirements for proper well construction.

Drilling methods that cannot adequately advance through hard materials such as gravel, rock and tight clays should not be used in these conditions. As an example, Hollow-Stem Auger rigs are not suitable for drilling through the Arundel Clay in the District. Similarly, a Bucket Auger is not suitable for advancing a borehole through the Arundel Clay.

Direct Mud Rotary drilling, while typically suitable for use in the Arundel Clay, can exacerbate the vertical movement of pollutants in the subsurface. At the contaminated site or where a groundwater contaminant plume is known or suspected to be present, a Mud Rotary drill rig would need to use casing advancement, such as a drill through casing driver or a dual rotary advancement as a pollution preventative measure.

10.4.4 Well Construction – Acceptable Drilling Methods

Regarding acceptable drilling methods for well construction, maintenance, and abandonment activities, the Well Permit Applicant maintains the responsibility to provide a complete Well Construction Work Plan including a drilling method that is appropriate for site specific conditions. Site specific conditions include known or suspected contamination, (Recognized Environmental Conditions), depth to groundwater, perched water zones, and soil cohesiveness. DOEE reserves the right to make determinations regarding the acceptable drilling methods.

10.4.5 Well Construction – Use of Drilling Fluids

Per Well Regulation §1814, regarding the use of drilling fluids for well construction, maintenance, and abandonment activities:

All the drilling fluids to be used in the district shall use only potable water to create a water-based drilling fluid and; the use of additives should be approved by DOEE in the well construction permit application by demonstrating that the additive does not pose a hazard to public health, environment and safety.

10.4.6 Well Construction – General

Additionally to the well construction requirements from the well regulations §1809, a Well Owner is required to install temporary and/or permanent outer casing during well construction to prevent aquifer cross-contamination at a contaminated site. The use of Temporary and/or Permanent Outer Casing shall be determined based upon the type of contamination and where it is found vertically and horizontally at a site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, a Well Owner is required to install temporary outer casing when the drilling method (e.g., direct mud-rotary drilling) does not include dual casing and drilling fluids are used to create the borehole.

Appendix B contains a decision tree for well construction at uncontaminated or contaminated fill/alluvium and at well sites in the Potomac Group. Use of temporary or permanent outer casing in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Contaminated deeper aquifers under confining pressure (resulting in upward vertical gradients) that are penetrated during drilling require adherence to specific protocols. A permanent outer casing should terminate in a confining unit above the contaminated zone. This casing will be grouted and allowed to set prior to advancing the borehole into the contaminated zone. The outer casing will maximize chances of controlling artesian flow; contain the flow within a casing if drilling fluid weight is insufficient to overcome the pressure of the flow; and stabilize the soil around the wellhead. Management of contaminated derived waste (e.g., cuttings and fluids) then becomes a requirement. The use of a down-hole packer or water-tight well cap may be required if artesian flow occurs to minimize the volume of contaminated water discharging from the well.

The annular space between the outer casing and well casing should be grouted. Bentonite slurry grouts have little ability to resist axial forces that can displace the grout seal in artesian flow, making bentonite grouts unsuitable for high hydraulic gradient sealing locations where strength is important. Bentonite chips or a mixture of bentonite and cement can be used depending on site conditions.

10.4.7 Well Construction – Geology

The geology of a site can complicate the proper design of Recovery Wells. Geological factors can produce aquifers that are anisotropic. In an anisotropic aquifer, groundwater moves faster in one direction than another and oblique to the hydraulic gradient. Anisotropy can result from various sedimentary or structural features such as buried channels, bedding planes, folds, faults, and fractures. In The District of Columbia, most of groundwater flow is either through fractured rocks from the Piedmont or granular materials from sedimentary rocks belonging to the Coastal Plain. Fracture flow in Piedmont bedrock requires additional considerations compared to flow in unconsolidated materials from the Coastal Plain.

Bedrock may exhibit small effective porosities and low hydraulic conductivities that impede groundwater flow. However, its secondary porosity may allow substantial flow of groundwater through fractures, joints, cleavage planes and foliations. These features tend to be highly directional, exhibit varying degrees of interconnection, and may produce local groundwater flow regimes that can be different from the regional trends. The sedimentary bedding planes and distribution and nature of the Coastal Plain also have significant effect on groundwater flow,

presenting a series of aquifers and aquitards at different depths. The recent sedimentary deposits (alluvium, artificial sill and fluvial terraces) and the weathered bedrock (Saprolite) conform most of the District unconfined aquifer including perched groundwater conditions in the Coastal Plain area of the District. It is important to understand the characteristics of the Hydrogeologic System of DC before designing any well.

10.4.8 Well Construction – Siting

Per Well Regulation §1810, the wells drilled and constructed have to be accessible for maintenance, inspection and abandonment and not be constructed within or under any building,

A utility clearance study is needed to located utility lines and also a search or investigation to identify any pre-existing subsurface structures (tunnels, diversion sewers, metro, etc.).

If the well is sited within the one hundred (100)-year floodplain or any other area prone to flooding, the top of the well head has to be is at least twenty-four (24) inches above the finished grade and fully protected from surface water intrusion (§1820.2).

A well shall be located a minimum of twenty-five feet (25 ft) of the higher watermark of any water body of the District or wetland.

10.4.9 Well Construction – Well Relocation

Per Well Regulation §1811, the relocation of a well during construction for the avoidance of utility lines and other obstacles can be done if the relocation is not more than ten feet (10) from the approved location and belongs to the same lot and square number and if drilled, the unsuccessful well has been properly abandoned in accordance with the requirements of the well regulations.

Well setback distances required in the Well Regulation are maintained.

10.4.10 Well Construction – DOEE Schematics

To facilitate permit applications for well construction in the District, DOEE has developed general well schematics for wells in bedrock and in confining units, and also indicating the location of the outer casing. The Well Schematics are based on the Well Regulation requirements, and are to serve as a template with fillable spaces to indicate the Well Owner particular well design details to comply with the Well Regulations. The Schematics to use for Recovery Wells can be either the general well schematics presented in chapter 5.4.10 or the water supply wells schematics from chapter 11.4.10.

10.4.11 Well Construction – Sanitary Protection

Per Well Regulation §1812, Sanitary protection has to be properly installed for each well and conduct protective measures during the well construction to protect the well and any water-bearing formation against contaminants from any source and surface water drainage.

If contaminants not addressed in the well construction permit are found during the drilling, the responsible of the well should stop the well construction, notify DOEE and follow the procedure described in the well regulations.

10.4.12 Well Construction – Well Casing

Per Well Regulation §1815, the well materials, fittings, and equipment, must be appropriate, and approved by the American Society for Testing and Materials (ASTM), the American Water Works Association (AWWA), or the (National Sanitarium Foundation) NSF International and do not poses a hazard to public health and Safety. Additional details can be found in the well regulations.

10.4.13 Well Construction – Well Screens

Per Well Regulation §1816, the well screens installed in wells should not extend across more than one aquifer and installed in a way that prevent the cross-contamination of aquifers, the materials shall have sufficient strength and the design shall be appropriate to the aquifer materials.

10.4.14 Well Construction – Filter Pack in Well

Per Well Regulation §1817, the filter pack of a well should be clean and free of toxic materials and substances and the design should be appropriate to the aquifer materials encountered. The responsible of the well design and construction shall be familiar with the restrictions and exemptions from the Well Regulations. A filter pack shall not contain iron or manganese in concentrations greater than that in the ground when the well is installed or adversely affect the quality of water withdrawn from the well or the groundwater that comes into contact with the filter pack.

10.4.15 Well Construction – Well Grouting

Grouting Administrative Procedures (Per Well Regulation §1818)

A request may be made to DOEE in accordance with §1803.10 and §1803.11 to deviate from the grouting standards of the Well Regulations, provided the deviation does not result in a less protective standards than those set forth in the Regulations.

DOEE may impose additional requirements pertaining to the grouting of a well in the well construction permit to ensure the protection of public health and safety and the environment.

In addition to §1818, specifications regarding grouting, a sodium-based bentonite grout should be fully hydrated in accordance with the manufacturer's specifications. Over hydration can lead to slumping and cracking when the grout begins to dry out above the saturated zone. The choice between a pure sodium-based bentonite grout and a sodium-based bentonite-cement mixture that is predominantly comprised of cement is dependent on the intended use of the grout and site conditions.

A pure bentonite slurry grout is suitable below the saturated zone but will tend to dry out and crack in the unsaturated zone. This material typically should be used for a well screened in the saturated zone but extending up through the unsaturated zone a bentonite-cement grout should be used according to the regulations.

10.4.16 Well Construction – Well Development

In addition to Well Regulation §1819 regarding the requirements for Well Development, DOEE expects that a properly designed, constructed and developed well in a non-fill area will be able to easily attain a turbidity level of 10 NTUs. As in-situ fine-grained sediments in fill areas may present development challenges, the regulation allows well development to be completed if all field parameter values stabilize and turbidity values do not exceed 20 NTUs. However, for a monitoring well, the turbidity level must stabilize at 5 NTUs, and the pH, specific conductivity, temperature, and turbidity of the water recovered from the well are determined to be within a ten percent (10%) range and considered at equilibrium.

10.4.17 Well Construction – Well Caps & Upper Terminus of Well

Per Well Regulation §1820, the upper terminus of a well shall meet the requirements of the regulations, unless otherwise approved in writing by DOEE. The most common upper terminus of wells: Flush mount and Stick up are considered in the DOEE Schematics presented in 5.4.10 and in 11.4.10:

10.4.18 Well Construction – Well Labeling

Per Well Regulation §1821, a well registration number issued by DOEE in accordance with§1806 shall be attached or labeled at a visible location to the terminal surface of a well.

A well registration label shall not be required for a soil boring, monitoring well, observation well, or piezometer, injection well, or recovery well provided the well is abandoned within thirty (30) days of well completion in accordance with the well regulations.

10.4.19 Well Construction – Supplemental Requirements for Construction

According to Well Regulation §1825, the materials and the methods used to construct, maintain, and abandon a recovery well must be compatible with the chemical and physical properties of the pollutants known to exist or potentially exist where a well will be sited.

A recovery well borehole does not penetrate to a depth greater than the depth from which contaminants are to be recovered. If it does, the well must be grouted in accordance with Well Regulation § 1818 (requirements for grouting), and the effluent of the recovery well must not be discharged to the waters of the District prior to obtaining all applicable District and federal permits.

10.5 Well Use and Maintenance Requirements

Per Well Regulation §1827, the well maintenance is mandatory.

Well maintenance typically is performed to avoid impairment of the groundwater; prevent corrosion and safety hazards; address limitations in well use due to clogging of the well screen or water intake; and lower turbidity levels.

Well maintenance must be performed using physical methods such as, scrubbing and well redevelopment prior to the use of chemical treatment. Mild chemical treatment with minimal impact to groundwater and well structural integrity shall be applied and the results shown to be ineffective before a well owner may propose the use of harsh or strong chemicals.

The Owner of a Well in a contaminated area will regularly inspect the well to ensure that its structural integrity is not compromised by the contaminants and any remediation practices at the site, and report any indication of known or potential failure to DOEE.

A well maintenance work plan involving chemical treatment must include:

- details of the well;
- the maintenance problem and supporting documentation such as, changes in water level data, water yield data, water chemistry data, color, taste, or odor;
- downhole video camera inspection findings;
- photographs;
- details and results of physical methods used to clean the well screen and any equipment such as, pumps and lines;
- the proposed action including the products to be used, the treatment process and endpoints, duration of treatment, the expected impact on the waters of the District during treatment, and how the impact will be minimized and reversed;
- SDS and manufacturer's specifications for proposed chemical products;
- sampling protocols during treatment, monitoring locations, sampling frequency, analytes to be sampled, and USEPA-approved laboratory methods with appropriate detection and reporting limits that will be used;
- data Quality Assurance and Quality Controls;
- laboratory NELAC certification;
- well driller's license and business license to operate in the District of Columbia;
- copy of the current well permit and registration;
- information about solid and effluent disposal including the effluent discharge location and treatment prior to discharge, if applicable;
- a map or figure showing the location of the well, site features, property lines, nearest street intersection, scale bar and north arrow;
- proposed treatment schedule; and
- any other details.

A recovery Well Owner proposing to increase groundwater withdrawal will present the request with supporting documentation including projected impacts on the aquifer to DOEE for review and approval.

Permanent or long-term withdrawal within a groundwater recharge area is not recommended as it may prevent or limit groundwater recharge in an aquifer. A Well Permit Applicant proposing to site a recovery well in such a location shall need to demonstrate to DOEE's satisfaction that likely detrimental effects on the aquifer, such as a long term decline in the available resource, subsidence, changes in water chemistry, saltwater intrusion, reduced baseflow to streams, etc., will not occur.

The discharge of fluids withdrawn from a well to a separate storm water sewer or waters of the District may cause a violation of the District Water Quality Standards in Chapter 11 of Title 21 of the District of Columbia Municipal Regulations (DCMR), result in acute or chronic exposure to aquatic biota, or pose a hazard to the public health and safety or the environment. No discharge is allowed without obtaining applicable District and federal permits.

10.6 Well Abandonment Requirements

10.6.1 Well Abandonment – Procedures

The accepted well abandonment procedures in the District are listed in Well Regulation §1831 are:

- Rip or perforate the well casing below ground surface;

Rip or perforate the casing followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting of the well annulus, or the well annulus was allowed to be backfilled with cuttings. The grout will flow through the openings or perforations to seal any porous zones along the outside of the casing. A minimum of five perforations per linear foot of casing or screen is recommended (American Society for testing Materials, Standard D 5299-99, 2012). After the rip or perforating in complete, the borehole must be grouted according to the procedures listed on chapter 13.5 and the upper 5 feet of borehole restored with suitable materials to create a cover similar to that of the surrounding area, such as concrete, asphalt or native soils or a combination of these materials.

- Over-drill the well casing for removal;

Over-drilling is the abandonment technique used to remove an entire well, its sand or gravel pack and the old grout column and fill. In situations where PVC screens and risers are expected to sever and removal of all well materials is required, over drilling technique is required. Over-drilling is used when a riser cannot be pulled and it penetrates a confining layer. It is a method commonly used for monitoring wells.

A temporary casing may be required when conditions are present such a high concentration of mobile contaminants in the upper layers (fill, alluvium or granular materials), depth to water is shallow or perched aquifer conditions, there is poor construction documentation or bad construction practices. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling, pulling, grouting within this casing. The casing is recovered at the end of pulling, grouting and drilling. If the confining unit is less than 5 feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of 2 feet below the top of the confining layer. After the outer casing has been set, the well can be removed and grouted through pulling if possible or removed and grouted by drilling inside the casing.

Over-drilling is recommended where casing pulling is determined to be unfeasible, or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled.

As a precaution, the well column should be filled with grout before over-drilling.

Prior to over-drilling, the bottom of the well should be perforated or cut away, and the casing filled with grout.

Over-drilling should advance beyond the original bore depth by a distance of half a foot to ensure complete removal of the construction materials.

- Submit an alternate abandonment procedure to the Department for approval in accordance with §§ 1803.10 and 1803.11.

In any method selected by the applicant, DOEE expects that the abandoned well will be filled and sealed in an effective and permanent manner that prevents vertical fluid migration within the well or the annulus surrounding the well casing.

10.6.2 Well Abandonment – Report

A well Abandonment Report submitted to DOEE must include the following details:

The relevant DC Well Abandonment and/or DC Well Construction Completion Forms.

If more than one well/boring was installed or abandoned, use only one Completion or Abandonment form and provide a boring matrix/schedule accounting for all wells and borings installed under the DCRA permit whether or not they were abandoned or still in use. Note on the form that the information is stated on the attached matrix/schedule. The matrix/schedule should provide the following details:

- Well Identification Number;
- Date of completed installation or abandonment;
- Type of well;
- Borehole depth below ground surface;
- Borehole diameter;
- Screened interval, if applicable;
- Geologic Formation or Aquifer the well is screened in (if known);
- Well location coordinates using Maryland State Plane Coordinate System or Latitude and Longitude; and
- Well elevation using NAV83.
- A site map drawn to scale with a north arrow, property lines, building footprints, the nearest street intersection, and the locations of all borings or wells whether or not they were abandoned or still in use;
- A scaled site map with scale bar;
- A north arrow;
- Property lines showing public space;
- Building footprints;
- The nearest street intersection; and

- Locations of all on-site wells/borings including those that were proposed and those to be abandoned.
- Photographs showing the abandonment procedure;
- All the Boring logs generated under the well permit;
- Any additional comments.

10.7 Special Conditions – Grouting and Sealing

Refer to Section 13 of this Well Guidance Document for general standards and procedures for grouting wells during construction and for sealing wells during abandonment and in order to potentially prevent the introduction and/or migration of contaminants.

10.8 Special Conditions – Contaminated Sites

Refer to Section 14 of this Well Guidance Document for detailed information and the requirements for contaminated sites.

10.9 Conditions – Derived Material Management

Refer to Section 15 of this Well Guidance Document for detailed information and the requirements for derived material management.

10.10 Special Conditions – Decontamination

Refer to Section 16 of this Well Guidance Document for detailed information and the requirements for decontamination.

10.11 Special Conditions – Geologic and Hydrogeologic Environment

Refer to Section 17 of this Well Guidance Document for supplemental information regarding the geologic and hydrogeologic environmental conditions of the District.

Chapter 11 Water Supply Well Requirements

11.1 Definitions

- Well – any test hole, shaft, or soil excavation created by any means including, but not limited to, drilling, coring, boring, washing, driving, digging, or jetting, for purposes including, but not limited to, locating, testing, diverting, artificially recharging, or withdrawing fluids, or for the purpose of underground injection. [Statutory]
- Water Supply Well – a potable or non-potable well used to supply water for industrial, irrigation, or domestic purposes.
- Domestic Supply Well – a water supply well used for potable water supply purposes, including drinking, bathing, showering, cooking, dishwashing, and maintaining oral hygiene.
- Industrial Supply Well – a non-potable water supply well used to supply water to an industrial or commercial facility for use in the production of goods and services.
- Irrigation Supply Well – a non-potable water supply well used for irrigating land, crops, or other plants other than household lawns and gardens.

DOEE recognizes that a Water Supply Well may be used for other purposes including public supply, general agriculture, aquaculture, and thermoelectric cooling.

Note: EPA Region III has primary authority over the Public Water Supply Program in the District of Columbia. For a Public Water Supply Well, in addition to the requirements under 21 DCMR Chapter 18, the Well Owner must comply with all applicable EPA laws and regulations including the Safe Drinking Water Act and the National Primary Drinking Water Regulations at 40 CFR 141. All potable water supply well owners must comply with the Lead Free Act of 2014 and obtain EPA permission before installing and operating the well.

11.2 Applicable Forms, Work Plans, and Supplemental Guidance Documents

Provided below is a list of applicable forms, work plans and supplemental guidance documents over the life cycle of a well. The applicability of these documents may vary based on the specific requirements and site conditions for the well construction, maintenance, and abandonment activities. Refer to Section 1.5 of this Well Guidance Document for more detailed information.

- Well Construction Permit Application/Registration Form
- Well Construction Completion Report
- Well Development Log Form
- Well Pumping Test Application Form
- Well Additional Geographic Data Form

- Well Abandonment Application Form
- Well Abandonment Report
- Well Registration Form/Completion Form (applicable for a well permitted before the Well Regulations were promulgated)
- Well Change-In-Use Form
- Well Change-in-Ownership Form
- Well Construction Work Plan
- DC Map of Known Wetlands and Waterbodies
- Hydraulic Conductivity Chart of Borehole Sealants
- District of Columbia Geologic Map
- Supply Well Schematic-Bedrock
- Supply Well Schematic-Confining Unit
- Multiple Well-Boring Data Collection Sheet
- Grouting Calculation of Bentonite-Cement-Water Ratios

DOEE has prepared a list of instructions for each Form and Spreadsheet to assist applicants with their completion.

11.3 Objective of Supply Wells

District of Columbia's groundwater is a critical resource that provides environmental benefits and contributes to the well-being of the citizens of the District and, in specific cases, a source of water.

Groundwater supplies currently do not provide for the drinking water needs of the District, but future needs or emergency situations could change this. In the past it represented the only practical source of water for domestic uses. Preserving the quality of groundwater is important for its use and potential use as source of water or reserve. Additionally, groundwater is critical to the protection of The District's surface streams since it provides the sustaining baseflow to the District's surface waters.

Supply Wells are intended to provide potable or non-potable water supply for industrial, irrigation, or domestic use.

Independently to the use of the supply well installed, DOEE expects high quality standards during the design, drilling and construction to provide the best quality of water for the intended use in a sustainable manner, reducing any environmental impact to the District's aquifers to the minimum.

11.4 Well Construction Requirements

11.4.1 Applicability Standards

Per Well Regulation §1801, Well Permit Applicants shall review the Well Guidance Document and the Well Regulations in order to determine the applicability of their well-related activities under the regulations and how to proceed with the well permitting process.

According to the Well Regulation § 1801.2:

"A person shall not construct, maintain, or abandon a well in a manner that may create a point source or non-point source of pollutants to waters of the District, impair the beneficial uses of waters of the District, or pose a hazard to public health and safety or the environment."

To comply, the well owner has to ensure that, where applicable:

- Well construction is in accordance with §§ 1809 through 1826;
- The use and maintenance is conducted in accordance with §§ 1827 through 1829; and
- The abandonment of the well is conducted in accordance with §§ 1830 through 1831.

11.4.2 DOEE Supplemental Guidance for Supply Wells

A water supply well intended to supply water for at least 60 days, to at least 25 individuals or having at least 15 connections, must meet the requirements of the Safe Drinking Water Act.

An applicant must notify EPA prior to entering into a financial commitment for initiating construction of a well to be used for public water supply, pursuant to 40 CFR §141.5. Notification to EPA and EPA's response to confirm that a well owner will or will not be subject to the National Primary Drinking Water Regulations at 40 CFR Part 141 must be provided as part of the well permit application to DOEE.

For all the supply wells, as a requirement for the permit, the applicant should provide a ground water investigation includingthe following:

1. Estimated annual quantity required, estimated pumping rate and target aquifer (if known)
2. A qualified Hydrogeologist with proven experience conducting similar investigations should supervise/conduct the investigation.
3. At the conclusion of the groundwater investigation developing a suitable groundwater source, the applicant is required to submit copy of the groundwater Investigation Report: The Groundwater groundwater Investigation Report report should contain the following information:
   (a) A map showing the extent and location of the project including pumping wells, observation wells, pipelines, test holes (all of them surveyed), and surrounding well users in the same aquifer.
   (b) A field verified inventory of all wells within 2 miles (or more if the well radius of influence exceeds the 2 miles) of the project including owners name, location, type of well and depth; and depth to the static water level.
   (c) Inventory and Identification of potential sources and existing contaminated sources in the surroundings.

(d) At least two geological cross-sections defining the target aquifer. All test and drilling and analyses should be supervised by a qualified Hydrogeologist.

(e) At least two permanent observation wells (piezometer) completed and sealed in the target aquifer or aquifers affected by the well.

(f) Provide the well information: borehole geophysical logs, descriptive logs of all test boreholes; copies of well and observation wells completion records.

(g) A minimum 72-hour constant rate pumping test-casing elevation of pumping well and observation wells; depth to static water level in pumping and observation wells; draw-downs in pumping and observation wells; time and pumping rate; and recovery measurements in pumping and observation wells after pumping has stopped; the recovery period shall be of the same duration as the pump test or until the aquifer has recovered to pre-pumping level.

(h) An analysis of the pumping test and recovery data with estimates of the well yield and aquifer yield stating the method of analysis and assumptions used.

(i) A water chemistry analysis, detailing the major ions and including hardness, alkalinity, pH, and conductivity. An analysis for metals is also recommended and volatile organic compounds (VOCs), nitrate and bacteria. If total coliform bacteria are detected, a test must also be conducted for fecal coliform or E.coli., in addition to any contaminants likely on the property.

(j) An evaluation of the effects of the project on surrounding users (if any).

(k) The report should identify any potential adverse impacts to the aquifer and existing users and present any required measures for the mitigation of those impacts.

(l) When numerical ground water models (computer) are used for aquifer evaluation, USGS MODFLOW simulation code will be used preferably. The applicant can download free of charge the MODFLOW code variants and the MODFLOW utilities, Post processors, and Graphical User Interfaces (GUIs) from the USGS website: http://water.usgs.gov/ogw/modflow/ and the following information shall be supplied:

i. the name and type of model used;
ii. the input data;
iii. the boundary conditions;
iv. a sensitivity analysis;
v. all assumptions made;
vi. the results; and
vii. a discussion of the validity of the results.

4. In some cases a test well will be proposed in the work plan.

11.4.3 Use of Well Drillers in the District

Per Well Regulation §1808 (well drillers in the District), all the well activities requiring the use of a drilling rig (drilling, construction, maintenance and abandonment), require the supervision

of a licensed well driller. While the District has not implemented yet a Drillers' certification program, other states Driller licenses are acceptable.

11.4.4 Well Construction – Unacceptable Drilling Methods

Drilling methods for well installation that cannot advance temporary or permanent outer-casing during drilling (see Section 10.3.10) are considered unacceptable if any of the following conditions apply:

a. A site has known contamination or a Recognized Environmental Condition,

b. the well will penetrate perched groundwater or the groundwater table, or

c. the well will encounter strong upward vertical gradients (artesian flow).

Examples of drilling methods that are not recommended for some types of these conditions are the bucket auger drilling method and well jetting (EPA, 1993). Neither method can advance casing nor meet the regulatory requirements for proper well construction.

Drilling methods that cannot adequately advance through hard materials such as gravel, rock and tight clays should not be used in these conditions. As an example, Hollow-Stem Auger rigs are not suitable for drilling through the Arundel Clay in the District. Similarly, a Bucket Auger is not suitable for advancing a borehole through the Arundel Clay.

Direct Mud Rotary drilling, while typically suitable for use in the Arundel Clay, can exacerbate the vertical movement of pollutants in the subsurface. At the contaminated site or where a groundwater contaminant plume is known or suspected to be present, a Mud Rotary drill rig would need to use casing advancement, such as a drill through casing driver or a dual rotary advancement as a pollution preventative measure

11.4.5 Well Construction – Acceptable Drilling Methods

Regarding acceptable drilling methods for well construction, maintenance, and abandonment activities, the Well Permit Applicant maintains the responsibility to provide a complete Well Construction Work Plan including a drilling method that is appropriate for site specific conditions. Site specific conditions include known Recognized Environmental Conditions or suspected contamination, (depth to groundwater, perched water zones, and soil cohesiveness.

DOEE reserves the right to make determinations regarding the acceptable drilling methods.

11.4.6 Well Construction – Use of Drilling Fluids

Per Well Regulation §1814, regarding the use of drilling fluids for well construction, maintenance, and abandonment activities:

All the drilling fluids to be used in the district shall use only potable water to create a water-based drilling fluid and; the use of additives should be approved by DOEE in the well construction permit application by demonstrating that the additive does not pose a hazard to public health, environment and safety.

11.4.7 Well Construction – General

Additionally to the well construction requirements from the well regulations §1809, a Well Owner is required to install temporary and/or permanent outer casing during well construction to prevent aquifer cross-contamination at a contaminated site. The use of Temporary and/or Permanent Outer Casing shall be determined based upon the type of contamination and where it is found vertically and horizontally at a site. In an aquifer where individual contaminants are not spread throughout the water-bearing unit, a Well Owner is required to install temporary outer casing when the drilling method (e.g., direct mud-rotary drilling) does not include dual casing and drilling fluids are used to create the borehole.

Appendix B contains a decision tree for well construction at uncontaminated or contaminated fill/alluvium and at well sites in the Potomac Group. Use of temporary or permanent outer casing in varied subsurface settings is a primary consideration when designing a well and during the well construction work plan process.

Contaminated deeper aquifers under confining pressure (resulting in upward vertical gradients) that are penetrated during drilling require adherence to specific protocols. A permanent outer casing should terminate in a confining unit above the contaminated zone. This casing will be grouted and allowed to set prior to advancing the borehole into the contaminated zone. The outer casing will maximize chances of controlling artesian flow; contain the flow within a casing if drilling fluid weight is insufficient to overcome the pressure of the flow; and stabilize the soil around the wellhead. Management of contaminated derived waste (e.g., cuttings and fluids) then becomes a requirement. The use of a down-hole packer or water-tight well cap may be required if artesian flow occurs to minimize the volume of contaminated water discharging from the well.

The annular space between the outer casing and well casing should be grouted. Bentonite slurry grouts have little ability to resist axial forces that can displace the grout seal in artesian flow, making bentonite grouts unsuitable for high hydraulic gradient sealing locations where strength is important. Bentonite chips or a mixture of bentonite and cement can be used depending on site conditions.

The well construction will not be complete until the well has been properly disinfected.

Water use should be reported on an annual basis by type of use, amount withdrawn and withdrawal rate to DOEE.

11.4.8 Well Construction – Geology

The geology of a site can complicate the proper design and construction of the selection of the target aquifer zones for supply wells. Geological factors can produce aquifers that are anisotropic. In an anisotropic aquifer, groundwater moves faster in one direction than another and oblique to the hydraulic gradient. Anisotropy can result from various sedimentary or structural features such as buried channels, bedding planes, folds, faults, and fractures. In The District of Columbia, most of groundwater flow is either through fractured rocks from the Piedmont or granular materials from sedimentary rocks belonging to the Coastal Plain. Fracture flow in Piedmont bedrock requires additional considerations compared to flow in unconsolidated materials from the Coastal Plain.

Bedrock may exhibit small effective porosities and low hydraulic conductivities that impede groundwater flow. However, its secondary porosity may allow substantial flow of groundwater through fractures, joints, cleavage planes and foliations. These features tend to be highly

directional, exhibit varying degrees of interconnection, and may produce local groundwater flow regimes that can be different from the regional trends. The sedimentary bedding planes and distribution and nature of the Coastal Plain also have significant effect on groundwater flow, presenting a series of aquifers and aquitards at different depths. The recent sedimentary deposits (alluvium, artificial sill and fluvial terraces) and the weathered bedrock (Saprolite) conform most of the District unconfined aquifer including perched groundwater conditions in the Coastal Plain area of the District. It is important to understand the characteristics of the Hydrogeologic System of DC before designing any supply well.

11.4.9 Well Construction – Siting

Per Well Regulation §1810 (Siting), the wells drilled and constructed have to be accessible for maintenance, inspection and abandonment and not be constructed within or under any building,

A utility clearance study is needed to located utility lines and also a search or investigation to identify any pre-existing subsurface structures (tunnels, diversion sewers, metro, etc.).

A well must be located a minimum of twenty-five feet (25 ft) of the higher watermark of any water body of the District or wetland.

Specific Siting Requirements Domestic Supply Wells

A domestic supply well must be sited a minimum of one hundred feet (100 ft) from a sewer or a recognized environmental condition.

A domestic supply well or well used to provide water for potable use/human consumption must have a well vent terminating 18 inches above ground if no flood potential exists but otherwise terminating three feet above the 100-year flood level with a return bend facing downward and screened.

A domestic supply well or well used to provide water for potable use/human consumption will have a well casing terminating 18 inches above ground if no flood potential exists but otherwise terminating three feet above the 100-year flood level.

11.4.10 Well Construction – Well Relocation

Per Well Regulation §1811, the relocation of a well during construction for the avoidance of utility lines and other obstacles can be done if the relocation is not more than ten feet (10) from the approved location and belongs to the same lot and square number and if drilled, the unsuccessful well has been properly abandoned in accordance with the requirements of the well regulations.

Well setback distances required in the Well Regulations are maintained.

11.4.11 Well Construction – DOEE Schematics

To facilitate permit applications for well construction in the District, DOEE has developed two general well schematics for supply wells: in bedrock and in confining units, using either stick-up upper well terminus or pitless adaptor, and also indicating the location of the outer casing. The Well Schematics are based on the Well Regulation requirements and serve as a template with fillable spaces to indicate the particular well design details to comply with the Well Regulations.

The Schematics to use for Supply Wells including the pitless adaptor cases are presented in the following figures:

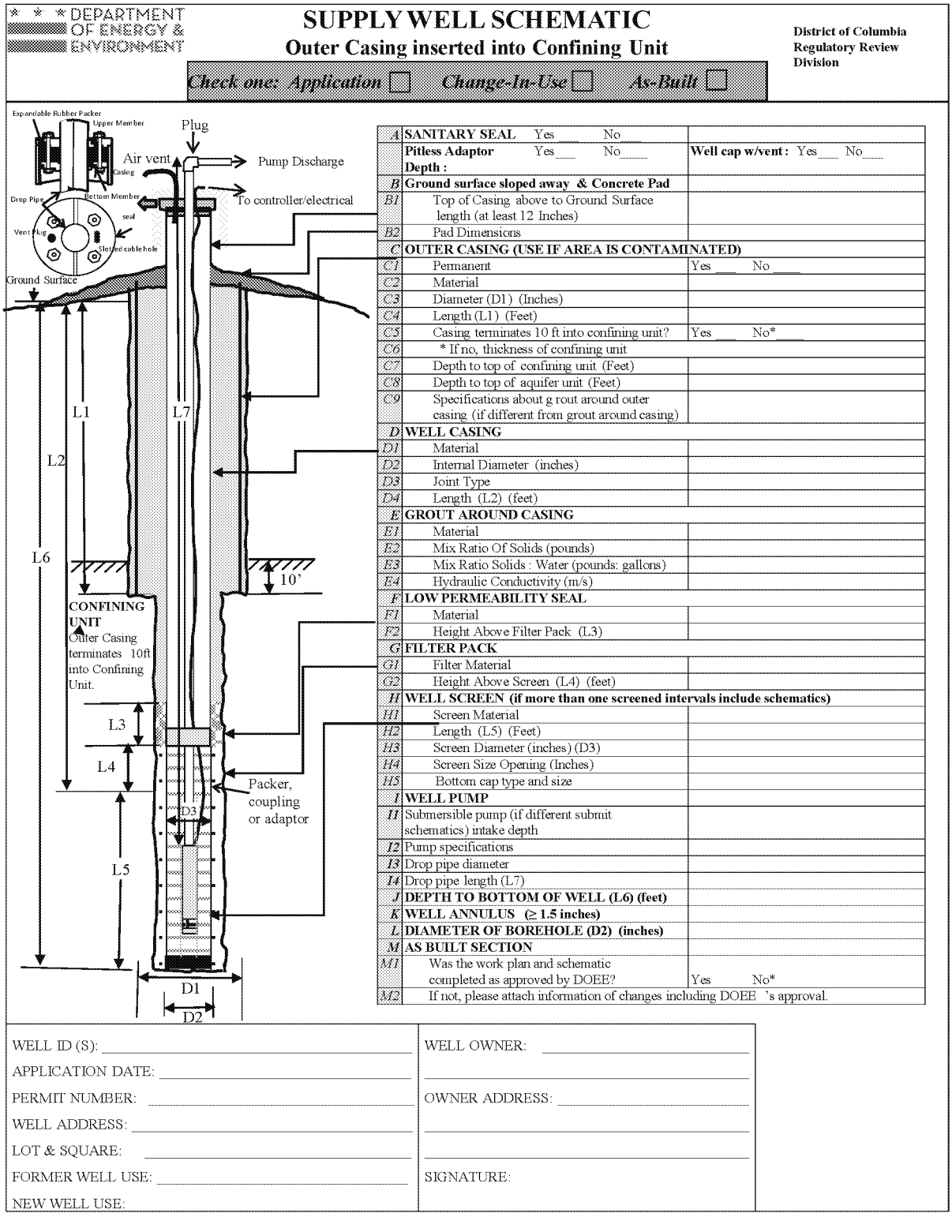


Figure 34 Supply well schematic for confining unit.

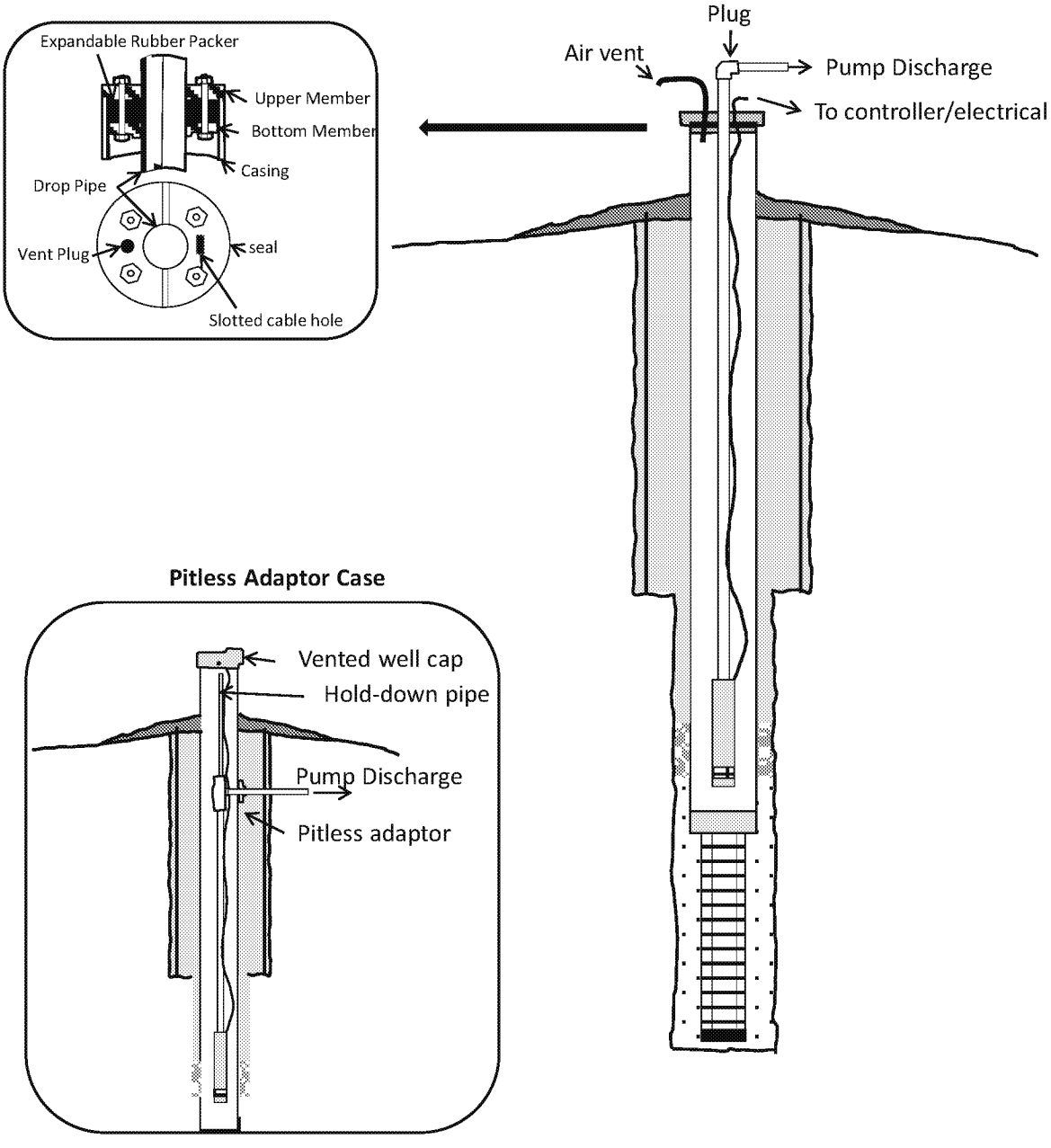


Figure 35 Page 2 of Supply well schematic for confining unit showing the pitless adaptor case (reverse of the page in the printed version).

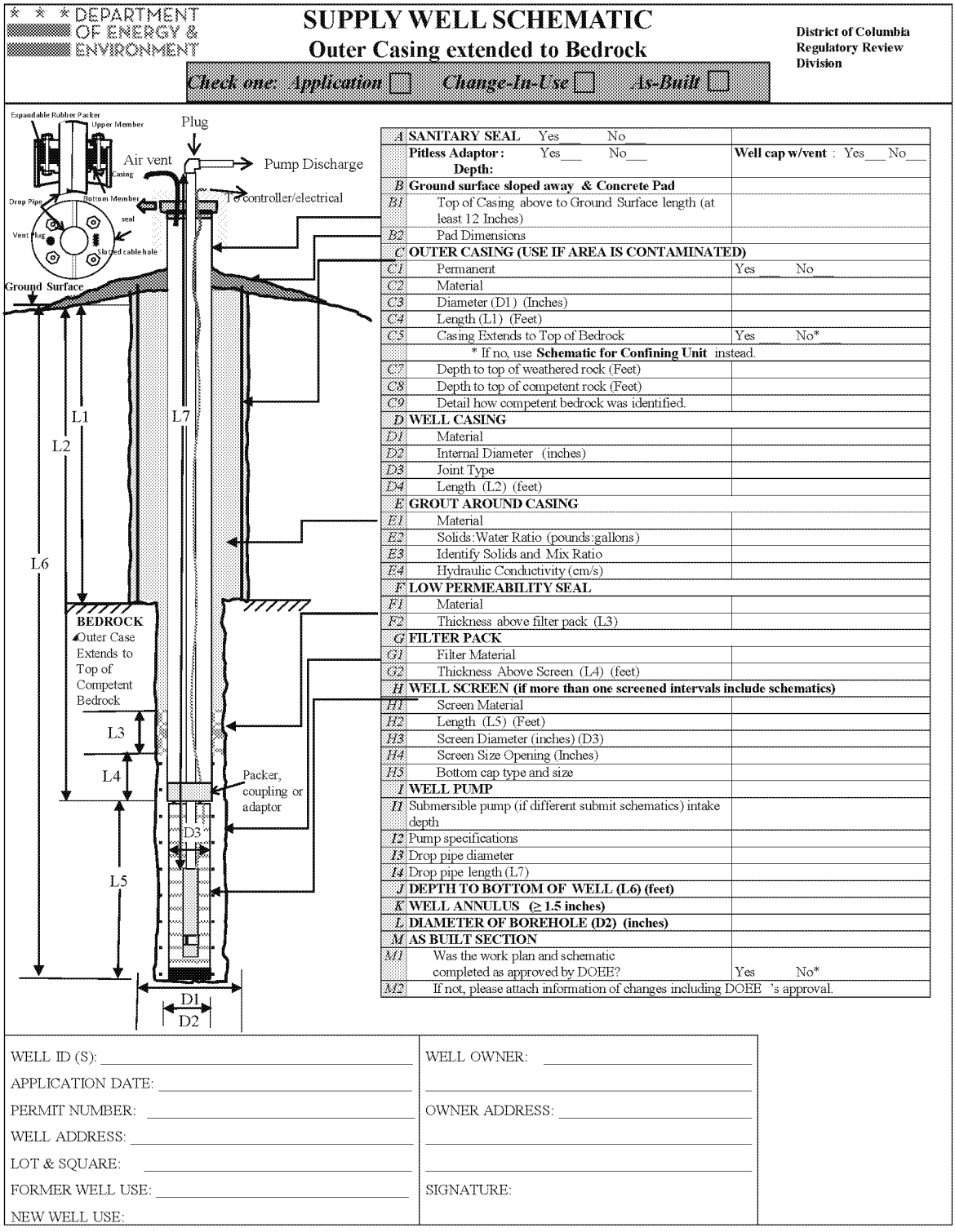


Figure 36 Supply well schematic for bedrock.

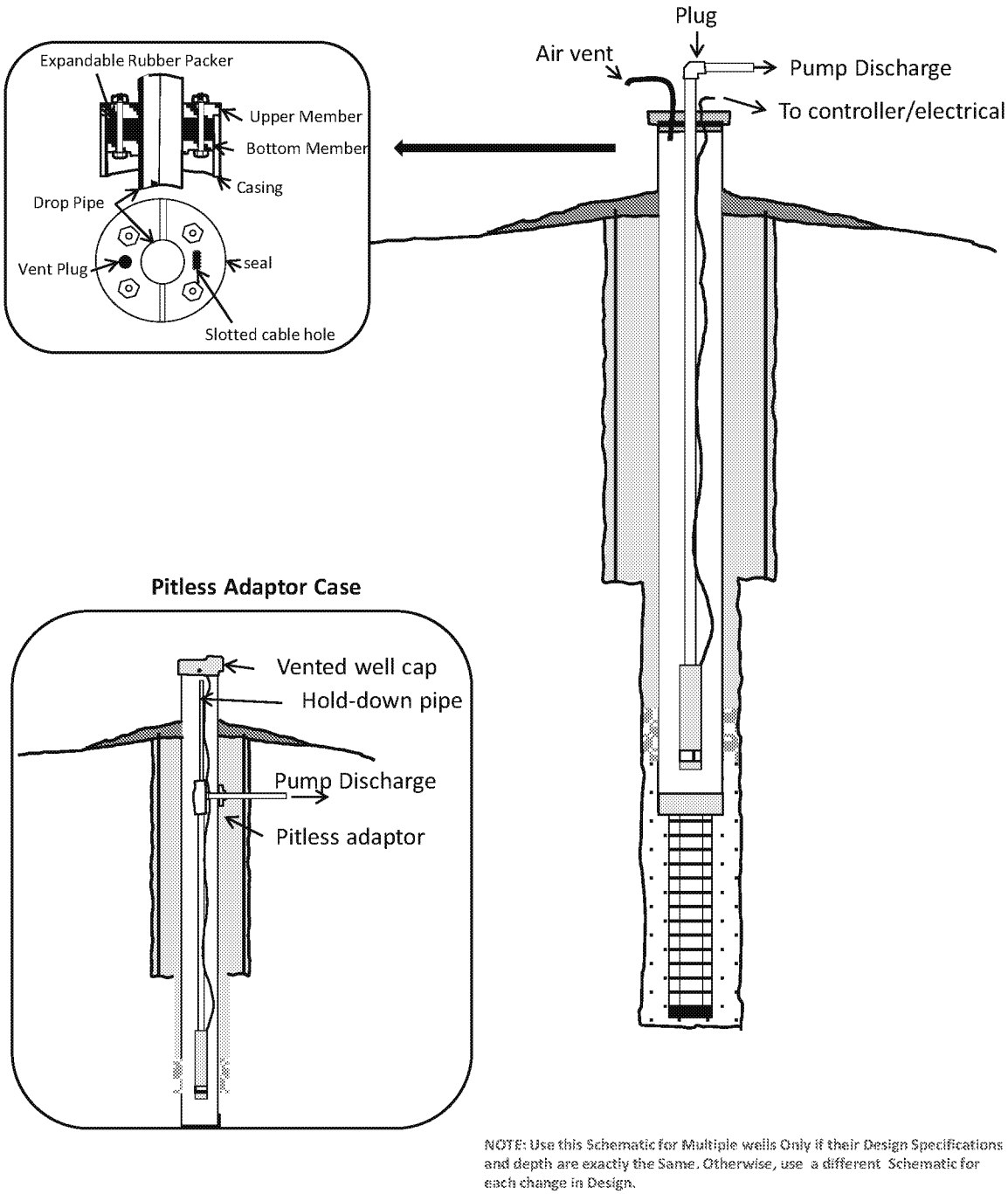


Figure 37 Supply well schematic for bedrock showing the pitless adaptor case (reverse of the page in the printed version).

11.4.12 Well Construction – Sanitary Protection

Per Well Regulation §1812 (sanitary protection requirements), sanitary protection has to be properly installed for each well and conduct protective measures during the well construction to protect the well and any water-bearing formation against contaminants from any source and surface water drainage.

If contaminants not addressed in the well construction permit are found during the drilling, the responsible of the well should stop the well construction, notify DOEE and follow the procedure described in the well regulations.

11.4.13 Well Construction – Well Casing

Per Well Regulation §1815 (well casing requirements), the well materials, fittings, and equipment, must be appropriate, and approved by the American Society for Testing and Materials (ASTM), the American Water Works Association (AWWA), or the (National Sanitarium Foundation) NSF International and do not poses a hazard to public health and Safety. Additional details can be found in the well regulations.

11.4.14 Well Construction – Well Screens

Per Well Regulation §1816 (well screen requirements), the well screens installed in wells should not extends across more than one aquifer and be installed in a way that prevent the cross-contamination of aquifers, the materials shall have sufficient strength and the design shall be appropriate to the aquifer materials.

11.4.15 Well Construction – Filter Pack in Well

Per Well Regulation §1817 (requirements for filter pack in well), the filter pack of a well should be clean and free of toxic materials and substances and the design should be appropriate to the aquifer materials encountered. The responsible of the well design and construction must be familiar with the restrictions and exemptions from the well regulations.

11.4.16 Well Construction – Well Grouting

Grouting Administrative Procedures (Per Well Regulation §1818)

A request may be made to DOEE in accordance with §1803.10 and §1803.11 to deviate from the grouting standards of the well regulations, provided the deviation does not result in a less protective standards than those set forth in the regulations.

DOEE may impose additional requirements pertaining to the grouting of a well in the well construction permit to ensure the protection of public health and safety and the environment.

Grouting Applicability (Per Well Regulation §1818)

In addition to §1818, there are other specifications regarding grouting. A sodium-based bentonite grout should be fully hydrated in accordance with the manufacturer's specifications. Over hydration can lead to slumping and cracking when the grout begins to dry out above the saturated zone. The choice between a pure sodium-based bentonite grout and a sodium-based bentonite-

cement mixture that is predominantly composed of cement is dependent on the intended use of the grout and site conditions.

A pure bentonite slurry grout is suitable below the saturated zone but will tend to dry out and crack in the unsaturated zone. This material typically should be used for a well screened in the saturated zone but extending up through the unsaturated zone a bentonite-cement grout should be used according to the regulations.

11.4.17 Well Construction – Well Development

In addition to well regulation §1819 (well development requirements), DOEE expects that a properly designed, constructed and developed well in a non-fill area will be able to easily attain a turbidity level of 10 NTUs. As in-situ fine-grained sediments in fill areas may present development challenges, the regulation allows well development to be completed if all field parameter values stabilize and turbidity values do not exceed 20 NTUs. However, for a monitoring well, the turbidity level must stabilize at 5 NTUs, and the pH, specific conductivity, temperature, and turbidity of the water recovered from the well are determined to be within a ten percent (10%) range and considered to be at equilibrium.

11.4.18 Well Construction – Well Caps & Upper Terminus of Well

Per Well Regulation §1820, the upper terminus of a well shall meet the regulatory requirements unless otherwise approved in writing by DOEE. As the upper terminus of a well provides a primary line of defense from surface water intrusion and other contaminants, the regulatory requirements will apply in the vast majority of cases. A borehole is not required to have an upper terminus if contaminant entry into the borehole is effectively prevented by other protective measures before it is properly grouted or abandoned. These measures include the use of a steel plate or similar sturdy cover surrounded by sand bags and marked by construction cones, tape or equivalent methods to warn of the borehole's presence. Plastic sheeting also may be used as an added layer of protection. Leaving the drill bit and augers in a borehole is not an acceptable protective measure to prevent contaminant entry.

The most common types of upper terminus used for wells are Flush Mounted and Stick Up. Both types are shown in the DOEE Schematics presented in 5.4.10.

11.4.19 Well Construction – Well Labeling

Per Well Regulation §1821 (well labeling), a well registration number issued by DOEE on a well tag must be firmly attached with wire, a nylon tie, or similar materials or labeled atto a visible location on the terminal surface of a well, such as the well casing below the well cap The registration number also may be written with permanent ink on to the top surface of the well cap or stenciled on the outside of the well. A well tag should not be put on the concrete well pad as it may be destroyed and cannot be returned to DOEE when the well is abandoned.

If a well registration tag is damaged and a replacement is required or the tag is not used and the Well Owner does not intend to install the well, then the tag should be returned to DOEE with an explanation. Well registration labels must beare unique to each DOEE- registered well and shall not be exchanged with, applied to, reused or duplicated for use by other registered or unregistered wells.

A DOEE-issued well registration tag must be returned to DOEE with the abandonment report when the well assigned that registration number is abandoned. Well abandonment is not considered to be complete and the well registration not ended until the assigned tag is returned.

11.5 Well Use and Maintenance Requirements

Well use and maintenance requirements are in the Well Regulation §1827. The Well Owner is responsible for ensuring that the water quality of a supply well is suitable for its intended use and complies with all relevant Federal and District laws and regulations. Some forms of well maintenance require a Well Construction Permit or DOEE-approved workplan while others do not.

Preventative maintenance includes a regularly scheduled visual inspection of the well. During the inspection, the surrounding area also should be checked for evidence of any nearby activities or occurrences that could negatively impact the well, such as storage of construction materials, use of heavy equipment that may accidentally hit the well, water ponding near a flush-mounted well; and dumping of trash. Where these conditions are noted, the Well Owner should take preventative measures to ensure continued protection of the well.

A Well Owner should regularly inspect of the well for any maintenance issues. Well maintenance typically is performed to avoid impairment of the groundwater; prevent corrosion and safety hazards; address limitations in well use due to clogging of the well screen or water intake; and lower turbidity levels. A maintenance inspection will vary depending on the type of well and upper terminus finish but generally should include a visual check for damage or cracks in the sanitary cap, airtight rubber gasket seal, electrical lines, and casing; corrosion; missing parts such as the manhole cover, bolts, well cap, or lock; and the condition of the well pad for flush-mounted wells. A well cap should be replaced approximately every two years or earlier if the seal is no longer effective. If the seal is not functioning properly, the inner surface of the blank casing may appear to be dirty, stained, or show evidence of the entry of foreign materials.

Well Pumps

A downhole well pump should only be removed, cleaned and reinstalled by a person trained and licensed to perform such work. If a pump is cleaned or repaired outside of the well by a professional well pump installer, a DOEE-approved workplan is not required. However, DOEE approval if the pump and lines are to be cleaned in the well using chemicals.

A well pump should not be changed out for one with a higher rating except if DOEE approves the replacement through the Change-In-Use application process. The Well Owner should provide supporting documentation and may be required to conduct studies and models to determine the new extent and impact of the increased water withdrawal.

A Well Construction Permit is required to deepen or make other dimensional changes to the well; install new components or reconfigure the components inside the well; or to change or replace the upper terminus. However, simple physical maintenance to the upper terminus of a well, such as the replacement of bolts, manhole covers, gasket seals, well caps and well pad repairs does not require a new Well Construction Permit.

Well Maintenance - Cleaning

Physical or chemical well cleaning may be necessary to address limitations in well use due to clogging of the well screen or water intake, and to lower turbidity levels. Well maintenance must be performed using physical methods such as, scrubbing and well redevelopment prior to the use of chemical treatment. Mild chemical treatment with minimal impact to groundwater and well structural integrity shall be applied and the results shown to be ineffective before a well owner may propose the use of harsh or strong chemicals.

Well Maintenance Workplan

A well maintenance work plan is required if involving chemical treatment is deemed necessary. The work plan is separate from the Well Construction Permit and must be reviewed and approved by DOEE before the work can begin. The workplan should shall include:

- details of the well;
- the maintenance problem and supporting documentation such as, changes in water level data, water yield data, water chemistry data, color, taste, or odor;
- downhole video camera inspection findings;
- photographs;
- details and results of physical methods used to clean the well screen and any equipment such as pumps and lines;
- the proposed action including the chemical product(s) to be used, the percent concentration of chemical product(s) to be added to the well; the treatment process and endpoints, duration of treatment, the expected impact on the waters of the District during treatment, and how the impact will be minimized and reversed;
- SDS and manufacturer's specifications for proposed chemical product(s);
- a calculation to convert the proposed percent concentration of the chemical cleaning agent to a mix concentration before it is applied in the well, and the volume that would result in a 50% Lethality Concentration in biota according to the SDS;
- reasons to support the selection of the specified chemical product(s);
- SDS and manufacturer's specifications for proposed chemical products;
- sampling protocols during treatment, monitoring locations, sampling frequency, analytes to be sampled, and USEPA-approved laboratory methods with appropriate detection and reporting limits that will be used;
- data Quality Assurance and Quality Controls;
- laboratory NELAC certification;
- a Spill Prevention and Cleanup Plan (SPCP);-well driller's license and business license to operate in the District;
- copy of the current well permit and registration;
- information about solid and effluent disposal including the effluent discharge location and treatment prior to discharge, if applicable;

- a map or figure showing the location of the well, site features, property lines, nearest -street intersection, scale bar and north arrow;
- proposed treatment schedule; and
- any other relevant details.

The SPCP has some components of a Stormwater Pollution and Prevention Plan but it specifically addresses well maintenance activities. The SPCP is necessary to:

- prevent the spread or continued presence of hazardous substances and wastes associated with the proposed chemical well maintenance above or below ground;
- have clear procedures and testing to demonstrate that applied chemicals are removed after application so that they do not pollute the waters of the District;
- have the chemical product properly stored, used and discarded in accordance with applicable Federal and District laws and regulations; and
- provide procedures to respond to spills or releases. The SPCP should include the following:
  - project contacts
  - a summary table stating the brand name of the materials to be used, the intended use, the volume of materials, onsite storage provisions, and spill containment measures covered by the Plan;
  - details of spill prevention and chemical storage;
  - best management practices for spill prevention;
  - site security;
  - inspection and maintenance;
  - operator training;
  - spill containment and chemical storage;
  - best management practices for spill containment;
  - containment measures;
  - spill response;
  - flowchart for spill response activities;
  - spill response materials and equipment;
  - emergency response contractor;
  - waste management;
  - reporting; and
  - figures showing spill response equipment, materials and placement

If the Well Owner demonstrates that constant well maintenance is necessary during a dewatering project, the Well Owner should include with the work plan a copy of a template table that will be

used to provide a monthly report to DOEE Water Quality Division regarding the wells that will be treated. The table should identify:

- the period of treatment;
- the pre- and post-treatment pH, specific conductivity, flow rate and water chemistry at each treated well, and
- any spills or releases that occurred during treatment.

Water Use

Well use and maintenance should not significantly deplete or degrade groundwater resources (21 DCMR 1827.6). DOEE considers any groundwater removal that limits or reduces stream flow, or groundwater levels at a groundwater-fed wetland, or a long-term decrease in the potentiometric surface as significant depletion. A Well Owner also should not allow an artesian flowing well to run to waste and the long-term groundwater flow regime should not be disrupted. As a result, a water supply Well Owner proposing to increase groundwater withdrawal is required to present the request with supporting documentation including projected impacts on the aquifer to DOEE for review and approval. The Well Owner also must first obtain permission from the EPA for changes involving a drinking water supply well, In addition, an action that causes an exceedance of the groundwater standards is deemed to be a significant degradation of groundwater.

Groundwater recharge is impacted by the placement of impervious materials over recharge areas. Permanent or long-term withdrawal within a groundwater recharge area is not recommended and also prevents or limits groundwater infiltration into the aquifer. A Well Permit applicant proposing to site a water supply well in such as a groundwater recharge area location shall need to demonstrate to DOEE's satisfaction that likely detrimental effects on the aquifer, such as a long term decline in the available resource, subsidence, changes in water chemistry, saltwater intrusion, reduced baseflow to streams, etc. will not occur or will be minimal at best.

11.6 Well Abandonment Requirements

11.6.1 Well Abandonment – Work Plan

Additionally to well regulation §1830 regarding the requirements to submit to the DOEE a well abandonment plan thirty (30) days before the well abandonment, and to complete the abandonment within sixty (60) days of DOEE approval of the plan, DOEE expects that an alternative abandonment procedure such as abandoning in place will be rarely proposed and be limited to wells with access problems. Possible examples include an old well discovered beneath a structural bearing wall of a building where only removal of the wall could allow removal of the well; a well in the middle of utilities that must not be removed or damaged such as, WMATA tunnels, DC Water Long Term Control Plan tunnels, and natural gas lines and the utilities that were placed after the well was installed. However, DOEE will not approve alternative abandonment procedures for wells because the site conditions may be difficult, inconvenient or more expensive such as wells near to trees, in busy traffic areas that would require lane closure.

The Well Abandonment Work Plan form (appendix A) was designed to include all the details and information required for well abandonment like: the reason(s) for abandonment; the depth and diameter of the well; the well abandonment details, including the procedures and materials

used; the details describing how any waste materials from the abandoned well or derived from well abandonment will be collected and disposed; the details regarding the well's condition and whether or not any obstructions exist that may potentially interfere with the abandonment processes; the well driller's name, address, telephone number, electronic mailing address, a copy of the pertinent Department of Consumer and Regulatory Affairs licenses, and a copy of the well driller's license; a statement signed by the well owner that the well will be abandoned in accordance with the well abandonment requirements of the well regulations; and any other relevant details.

11.6.2 Well Abandonment – Procedures

The accepted well abandonment procedures in the District are listed in Well Regulation §1831 are:

- Rip or perforate the well casing below ground surface;

Rip or perforate the casing followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting of the well annulus, or the well annulus was allowed to be backfilled with cuttings. The grout will flow through the openings or perforations to seal any porous zones along the outside of the casing. A minimum of five perforations per linear foot of casing or screen is recommended (American Society for testing Materials, Standard D 5299-99, 2012). After the rip or perforating in complete, the borehole must be grouted according to the procedures listed on chapter 13.5 and the upper 5 feet of borehole restored with suitable materials to create a cover similar to that of the surrounding area, such as concrete, asphalt or native soils or a combination of these materials.

- Over-drill the well casing for removal;

Over-drilling is the abandonment technique used to remove an entire well, its sand or gravel pack and the old grout column and fill. In situations where PVC screens and risers are expected to sever and removal of all well materials is required, over drilling technique is required. Over-drilling is used when a riser cannot be pulled and it penetrates a confining layer. It is a method commonly used for monitoring wells.

A temporary casing may be required when conditions are present such a high concentration of mobile contaminants in the upper layers (fill, alluvium or granular materials), depth to water is shallow or perched aquifer conditions, there is poor construction documentation or bad construction practices. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling, pulling, grouting within this casing. The casing is recovered at the end of pulling, grouting and drilling. If the confining unit is less than 5 feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of 2 feet below the top of the confining layer. After the outer casing has been set, the well can be removed and grouted through pulling if possible or removed and grouted by drilling inside the casing.

Over-drilling is recommended where casing pulling is determined to be unfeasible, or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled.

As a precaution, the well column should be filled with grout before over-drilling.

Prior to over-drilling, the bottom of the well should be perforated or cut away, and the casing filled with grout.

Over-drilling should advance beyond the original bore depth by a distance of half a foot to ensure complete removal of the construction materials.

- Submit an alternate abandonment procedure to the Department for approval in accordance with §§ 1803.10 and 1803.11.

In any method selected by the applicant, DOEE expects that the abandoned well will be filled and sealed in an effective and permanent manner that prevents vertical fluid migration within the well or the annulus surrounding the well casing.

11.6.3 Well Abandonment – Report

A well Abandonment Report submitted to DOEE must include the following details:

The relevant DC Well Abandonment and/or DC Well Construction Completion Forms (appendix B);

If more than one well/boring was installed or abandoned, use only one Completion or Abandonment form and provide a boring matrix/schedule accounting for all wells and borings installed under the DCRA permit whether or not they were abandoned or still in use. Note on the form that the information is stated on the attached matrix/schedule. The matrix/schedule should provide the following details:

- Well Identification Number;
- •of completed installation or abandonment;
- Type of well;
- Borehole depth below ground surface;
- Borehole diameter;
- Screened interval, if applicable;
- Geologic Formation or Aquifer the well is screened in (if known);
- Well location coordinates using Maryland State Plane Coordinate System or Latitude and Longitude, and
- Well elevation using NAV83.
- A site map drawn to scale with a north arrow, property lines, building footprints, the nearest street intersection, and the locations of all borings or wells whether or not they were abandoned or still in use;
- •scaled site map with scale bar;
- A north arrow;
- Property lines showing public space;
- Building footprints;
- The nearest street intersection; and

- Locations of all on-site wells/borings including those that were proposed and those to be abandoned.
- Photographs showing the abandonment procedure;
- All the Boring logs generated under the well permit;
- Any additional comments.

11.7 Special Conditions – Grouting and Sealing

Refer to Section 13 of this Well Guidance Document for general standards and procedures for grouting wells during construction and for sealing wells during abandonment and in order to potentially prevent the introduction and/or migration of contaminants.

11.8 Special Conditions – Contaminated Sites

Refer to Section 14 of this Well Guidance Document for detailed information and the requirements for contaminated sites.

11.9 Special Conditions – Derived Material Management

Refer to Section 15 of this Well Guidance Document for detailed information and the requirements for derived material management.

11.10 Special Conditions – Decontamination

Refer to Section 16 of this Well Guidance Document for detailed information and the requirements for decontamination.

11.11 Special Conditions – Geologic and Hydrogeologic Environment

Refer to Section 17 of this Well Guidance Document for supplemental information regarding the geologic and hydrogeologic environmental of the District.

Chapter 12 Other Well-Type Requirements

12.1 Purpose

The purpose of this Section is to provide general guidance to Well Owners or Well Permit Applicants regarding other well-types that are not specifically referenced in the Well Regulations.

These other well-types may include, but are not limited to: test pits, trenches, large diameter boreholes, borings used for jet grouting, secant piles, etc.

12.2 Applicability and Forms, Work Plans, and Supplemental Guidance Documents

Per DC Law §8-103.01(26A) of the Water Pollution Control Act, a "well" is defined as, "any test hole, shaft, or soil excavation created by any means including, but not limited to, drilling, coring, boring, washing, driving, digging, or jetting, for purposes including, but not limited to, locating, testing, diverting, artificially recharging, or withdrawing fluids, or for the purpose of underground injection."

The Well Regulations, (DCMR Title 21, Chapter 18 – Well Construction, Maintenance, and Abandonment Standards) currently provide requirements for the following well-types: borings, geotechnical wells, monitoring wells, observation wells, piezometers, closed-loop ground source heat pump wells, ground freeze wells, dewatering wells, injection wells, recovery wells, water supply wells, domestic water supply wells, industrial water supply wells, and irrigation water supply wells.

While the Well Regulation Regulations are applicable to all construction, maintenance and abandonment activities for wells in the District, for other well-types not specifically referenced in the Well Regulations, DOEE may require supplemental requirements on a case-by-case basis from DOEE.

Such requirements could include, but are not limited to: pre-application, post-application and pre-construction meetings; additional site investigations, site plans, design plans, modeling and reports regarding proposed well-related activities; and additional field meetings, inspections and continuous monitoring and reporting throughout well construction, maintenance, and abandonment.

12.3 Applicable Forms, Work Plans, and Supplemental Guidance Documents

Provided below is a list of applicable forms, work plans and supplemental guidance documents. The applicability of these documents may vary based on the specific requirements and site conditions for the well construction, maintenance, and abandonment activities. Refer to Section 1.5 of this Well Guidance Document for more detailed information.

- Well Construction Permit Application/Registration Form
- Jet Grouting/Secant Piling/Other Soil Stabilizing Well Construction Permit Application/Registration Form
- Well Construction Completion Report
- Well Development Log Form
- Well Pumping Test Application Form
- Well Additional Geographic Data Form
- Well Abandonment Application Form
- Well Abandonment Report
- Well Registration Form/Completion Form (applicable for a well permitted before the Well Regulations were promulgated)
- Well Change-In-Use Form
- Well Change-in-Ownership Form
- DC Map of Known Wetlands and Waterbodies
- Hydraulic Conductivity Chart of Borehole Sealants
- District of Columbia Geologic Map
- Well Schematic Flush-Mounted Wells-Bedrock
- Well Schematic Flush-Mounted Wells-Confining Unit
- Well Schematic Stick-Up Wells-Bedrock
- Well Schematic Stick-Up Wells-Confining Unit
- Well Schematic Boring-Bedrock
- Well Schematic Boring-Confining Unit
- Multiple Well-Boring Data Collection Sheet
- Grouting Calculation of Bentonite-Cement-Water Ratios

DOEE has prepared a list of instructions for each Form and Spreadsheet to assist applicants with their completion.

12.4 Supplemental Requirements

Per Well Regulation §1803.9, DOEE may require supplemental information related to the construction, maintenance, or intended use of a soil boring, recovery well, monitoring well, observation well, piezometer, industrial supply well, irrigation supply well, domestic water supply well, or any other type of well.

Per Well Regulation §1803.10, a Well Owner may request a special compliance standard or the modification of a requirement of this Section, if conditions or circumstances exist such that

compliance will result in poor construction, maintenance, or abandonment of a well or will preclude the construction of the well.

Per Well Regulation §1803.11, a request for a special compliance standard or modification shall be submitted in writing to DOEE for review and approval, and shall include:

a. A description of the circumstances or site conditions that warrant special consideration;

b. The proposed special compliance standard or modification request;

c. Documentation establishing that the proposed special compliance standard or modification is adequate and protective of public health and safety and the environment; and

d. The signature of the Well Owner certifying that the information in the request for the special standard is accurate and complete to the best of the owner's knowledge.

12.5 Well Pits, Sump Pits or Similar Excavations

a. The construction and use of a well pit, sump pit, or other similar structure installed or constructed below ground surface that can withdraw groundwater or otherwise impact the water resources of the District is considered to be a dewatering well and are regulated in accordance with the requirements of 21 DCMR 18. Such a structure maybe found at a site where other types of well construction activities such as, ground source heat pump, ground freeze, jet grouting and secant piling wells are being installed; or

b. mud rotary drilling or similar drilling method is being utilized, and the Well Owner proposes the use of infiltration ponds or sumps to manage the excess water at the site.

Chapter 13 General Specifications

13.1 Grouting and Sealing

13.1.1 Purpose

The purpose of this Chapter is to provide an overview of the general standards and procedures for grouting wells (i.e., wells, borings, boreholes, etc.) during construction, and for sealing wells (i.e., wells, borings, boreholes, etc.) during abandonment. Such standards and procedures are to be implemented in order to potentially prevent the introduction and/or migration of contaminants during well-related activities.

13.1.2 Definitions

- Hydraulic Conductivity – is a parameter measuring the ease with which flow takes place through a porous medium. Measurement of hydraulic conductivity or a flow rate typically uses units of velocity such as [L/T]. Hydraulic conductivity is dependent on the properties of the porous medium and the fluid. [Schwartz 2003]. Such properties include: intrinsic permeability of the material, the degree of saturation, and the density and viscosity of the fluid.
- Permeability (or Intrinsic Permeability) – is a parameter measuring the ability of a porous medium (such as soil or rock) to transmit fluid as the fluid moves through it. Permeability is independent of the fluid moving through the porous medium. [Schwartz 2003]
- Grout – any stable, impervious, bonding material reasonably free of shrinkage which is capable of providing a water-tight seal in the annular spaces of a well.
- Sealing – to construct a permanent groundwater flow barrier in order to restrict or prohibit the surface and/or subsurface movement of groundwater. [ASTM, 1994]

13.1.3 Applicability and Use of Hydraulic Conductivity and Permeability

Refer to the definitions of hydraulic conductivity and permeability. Published literature generally measures grouting activities and grout materials in terms of hydraulic conductivity.

Difference between Hydraulic Conductivity and Permeability (Intrinsic permeability)

Hydraulic conductivity (K) has units of length per time (L/T). It represents both the properties of the porous medium as well as the properties of the fluid flowing through the porous medium. It is clear that a viscous fluid like oil would move more slowly through sand than water would. To separate the properties of the porous medium from the properties of the fluid, a parameter is required to represent the size and the shape of the openings through which the fluid moves (Fetter, 2001). This parameter is called intrinsic permeability (K_i), which has units of length squared (L^2).

Using intrinsic permeability, we can express the hydraulic conductivity in terms of permeability:

$$K = K_i\left(\frac{\rho g}{\mu}\right)$$

where ρ is the density, g is the acceleration of gravity, and μ is the kinematic viscosity of the fluid phase. Intrinsic permeability is often expressed in square centimeters, or in darcys. A darcy is 9.87×10^{-9} cm^2. Ranges of intrinsic permeabilities and hydraulic conductivities for various sediments are listed in the table below.

Table 1. Intrinsic permeability and hydraulic conductivity for unconsolidated sediments (Fetter, 2001)

Material	Intrinsic Permeability (darcys)	Hydraulic Conductivity (cm/s)
Clay	$10^{-6} - 10^{-3}$	$10^{-9} - 10^{-6}$
Silt, sandy silts, clayey sands, till	$10^{-3} - 10^{-1}$	$10^{-6} - 10^{-4}$
Silty sands, fine sands	$10^{-2} - 10^{0}$	$10^{-5} - 10^{-3}$
Well-sorted sands, glacial outwash	$10^{0} - 10^{2}$	$10^{-3} - 10^{-1}$
Well-sorted gravel	$10^{1} - 10^{3}$	$10^{-2} - 10^{0}$

13.1.4 General Well Construction Grouting Standards and Procedures

Well grouting during construction (and other applicable activities) shall meet the criteria specified in Well Regulation §1818 to provide a water-tight seal against vertical migration along the well annulus into the filter pack, well screen, and surrounding aquifer. Natural geologic deposits hydraulic conductivity ranges several orders of magnitude (from 10-2 to 10-9 centimeters per second (cm/s)) with averages less than 10-4 cm/s.

To limit contaminant flow to more permeable zones in natural soils a well grout should have a hydraulic conductivity that is lower than the native soils to insure flow around the seal and not through the seal.

Per Well Regulation §1818, the "grouting of annulus of a well shall achieve a low-permeability seal with a hydraulic conductivity equal to or less than 1x10-7 centimeters per second (1x10-7

cm/s) and shall be comprised of a Sodium-based bentonite slurry.." Ratios of bentonite-water-cement are provided in §1818.11.

13.1.5 General Well Abandonment Sealing Standards and Procedures

Well sealing during abandonment (and other applicable activities) shall meet the criteria in Well Regulation §1831 in order to adequately protect the subsurface environment from contaminant transport.

A seal restores the subsurface stratigraphic column to a vertical hydraulic quality as good as or better than the pre-exploration condition. Borehole (or "well") seal types and associated hydraulic conductivity ranges as published by ASTM STP23902S.

Per Well Regulation §1831, the following materials shall be used for filling and sealing a borehole or well for abandonment:

"A sodium-based bentonite slurry; or

Hydrated, medium size, sodium-based bentonite chips or pellets, if:

The diameter of the well casing is less than one and one-quarter inches (1.25 in.) and the well is not over-drilled for abandonment; or

The well is no more than ten (10) feet below ground surface; and

The terminus of the well does not intersect the water table; and

The well is sited greater than twenty-five feet (25 ft) from the mean high watermark of a waters of the District or waters of the United States of America and twenty-five feet (25 ft) from a wetland."

In the event the diameter of a well does not allow for a slurry mixture to be emplaced using a tremie pipe, sodium-based chips or pellets shall be used.

Clay, silt, sand, gravel, crushed stone, and mixtures of these materials are considered fill material, and shall only be used under the following conditions:

- In soil borings in areas where no known or suspected, historic or current, groundwater or soil contamination exists;
- In a manner that shall mimic the original, stratigraphic layering of geologic units;
- In a manner that shall not create a conduit between aquifers;
- In a manner that shall not cause negative impacts to groundwater quantity or quality; and
- With prior written approval of DOEE. A well shall be abandoned by filling it with the appropriate sealing materials introduced at the bottom of the well by using a tremie pipe and placed progressively upward to at least two feet (2 ft) below ground surface. Implement measures to prevent surface water or potentially contaminated sources from entering the well or borehole.

The abandoned well shall be furnished with suitable materials to create a final cover similar to that of the surrounding area, such as a cold patch, or a non-coal tar based hot patch, or native

soils or a combination of these materials. Implement measures to prevent surface water or potentially contaminated sources from entering the well or borehole.

All abandonment sealing material shall be placed in one continuous operation using methods that prevent free fall, bridging, dilution, or separation of aggregates from cementing materials, unless otherwise approved by DOEE…"

13.2 Contaminated Sites

13.2.1 Purpose

The purpose of this Section is to provide an overview of the expected protocol for conducting a contaminant assessment at a proposed well site. A determination that potential contamination is present at a proposed well site results in specific well construction requirements, decontamination procedures, and management of derived wastes from well construction, use, maintenance and abandonment activities. DOEE will review environmental site assessments, corrective action plans site case histories, and other records and reports provided by the applicant and in its own files regarding contaminated sites in making the determination.

13.2.2 Definitions

- Contaminant – a biological, chemical, physical, or radiological material that poses a hazard to public health and safety or the environment, or interferes with a designated or beneficial use of the District of Columbia's waters.
- Contaminated Site – A site that contains a biological, chemical, physical, or radiological material that poses a hazard to public health and safety or the environment, or interferes with a designated or beneficial use of the District of Columbia's waters.
- Recognized Environmental Condition – the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property due to any release to the environment, under conditions indicative of a release to the environment or, under conditions that pose a material threat of future release to the environment. The term includes hazardous substances or petroleum products even under conditions in compliance with laws and regulations.

13.2.3 Determination of Known or Suspected Contamination

Well Permit Applicants are required to complete DOEE's Environmental Questionnaire as a supplemental form with DCRA well construction permit application. In addition, Well Permit Applicants shall provide information to DOEE through the Well Construction Permit Application process regarding known or suspected contaminated sites for all well construction, maintenance and abandonment activities. To determine if the proposed well site is a known or suspected contaminant site a contaminant assessment will be conducted and presented in the Well Construction Permit Application.

13.2.3.1 Contaminant Assessments

Well Permit Applicants will perform contaminant assessments to identify and characterize known or suspected contamination, contamination depths and contaminated media at sites for all well construction, maintenance, and abandonment activities.

One or more of the following information collection processes may be used to identify known or suspected contamination:

- ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (Transaction Screen);
- ASTM Phase I Environmental Site Assessment (Phase I ESA); or
- ASTM Phase II Environmental Site Assessment (Phase II ESA).

The District's Freedom of Information Act Public Access Website

The District of Columbia Governments Freedom of Information Act (FOIA) Public Access Website has an online FOIA request form founds at https://foia-dc.gov/palMain.aspx. This FOIA can be a component of the above information collection processes and can provide information on the following:

- Underground Storage Tank/Leaking Underground Storage Tank (UST/LUST) listings;
- Hazardous Waste records;
- DOEE records;
- Notices of Violation (NOV) and Notices of Infraction (NOI)
- UST/LUST Corrective Action Plan
- VCP reports
- RCRA or CERCLA reports

Whenever possible, final reports, findings and summarized Environmental Site Assessment (ESA) conclusions are required in the Well Construction Permit Application and Well Construction Work Plan. Previously conducted ESAs can be utilized, provided that the proposed well location is within the real-property assessed in the report, land use of the property has not changed since the report was prepared, and the collected data are accurate, reproducible and representative. Similar environmental reports that include summary of soil and/or groundwater quality can be utilized to meet the environmental information criteria. In addition, DOEE's Environmental Questionnaire Form is required to be filled out and submitted with a DCRA well construction permit application.

Contaminant concentrations are to be compared to the most current EPA Regional Screening Levels (RSL) to determine if the site will be considered contaminated and where special handling of derived wastes and dewatering fluids is required. Appropriate RSLs have a Target Cancer Risk of 1E-06 and Target Hazard Quotient of 0.1. RSLs applicable to residential exposures should be used on residential and commercial sites and industrial exposures used on industrial sites. Contaminant concentrations in groundwater or drinking water should be compared to the District's Groundwater Standards or if no criterion is provided, the EPA Maximum Contaminant Levels (MCLs).

Per Well Regulation §1813.2, "a Well Owner shall containerize all derived waste from the construction, maintenance, or abandonment of a well sited on a property where a recognized environmental condition has been identified and take the following measures. These measures are also applicable for sites with known contamination or unknown status.

- Representative sample(s) of the derived waste shall be collected and analyzed for known or suspected contaminants (specific contaminants to be analyzed are subject to contaminant source identified during the contaminant assessment or historical site use) by a National Environmental Laboratory Accreditation Conference-certified laboratory using appropriate EPA-approved procedures;
- All derived waste shall be stored and transported in United States Department of Transportation-approved containers; and
- All derived waste shall be permanently removed from the site for disposal in accordance with all District and federal laws and regulations."

For more detailed information regarding derived waste, refer to Section 15.5, Section 15.6 and Section 16 of this Well Guidance Document.

13.2.4 Management of Derived Solid or Liquid Waste

Soil and sediment materials including drilling cuttings, spoils, and rock, (i.e., that is, derived solid waste) from well construction, maintenance, and abandonment activities at contaminated sites, sites with recognized environmental conditions or sites being investigated for such conditions require special handling and disposal requirements. Refer to Section 16.5 and Section 16.5.1 of this Well Guidance Document.

Liquid materials including dewatering effluent; groundwater treatment system effluent; process water, decontamination water, well development water, purge water, dewatering effluent, drilling fluids and mud slurries, etc. (i.e., derived liquid waste) from well construction, maintenance, and abandonment activities at contaminated sites, sites with recognized environmental conditions or sites being investigated for such conditions require special handling and disposal requirements. Refer to Section 16.5 and Section 16.5.2 of this Well Guidance Document.

13.2.5 Disposal or Discharges of Derived Wastes – Permit Required

On-site disposal of derived solid and liquid waste such as soil; sediment; drill cuttings, drilling fluids and muds, decontamination and development water, spoils and rock, etc. is not permitted at sites with Recognized Environmental Conditions or known or suspected contamination. Representative samples of the derived waste can be collected and onsite disposal/discharge to ground surface can be conducted if the waste is determined to be uncontaminated.

Representative samples of derived waste from an uncontaminated site or where a Recognized Environmental Concern has not been identified can be collected and on-site disposal/discharge to ground surface at an uncontaminated site conducted if the waste also is determined to be uncontaminated.

Per Well Regulation §1813.5, "no person shall discharge the following into a separate stormwater sewer or waters of the District without obtaining applicable District and federal permits: dewatering effluent; groundwater treatment system effluent; process water; or derived waste." These requirements would also be applicable to: decontamination water, well development water, purge water, drill cuttings, drilling fluids and mud slurries.

Dewatering Wells and Other Well Construction requesting Discharges

All proposed Dewatering Wells will require representative groundwater samples to be collected and analyzed within the zone of influence. Specific contaminants to be analyzed are subject to potential contaminant sources identified during the Well Construction Permit Application process. Contaminant concentrations in groundwater should be compared to the District's Groundwater Standards (21 DCMR 1155) and DOEE's water quality standards (DCMR Chapter 21-11 Tables 1-3) or if no standard is provided, the EPA Maximum Contaminant Levels (MCLs), to determine if the dewatering well discharge will be considered contaminated and where special handling of derived wastes and dewatering fluids is required. Soil samples also should be collected and analyzed as contaminated soils may come in contact with stormwater that will be discharged from the site. The representative water quality data is to be provided in the Well Construction Permit Application and Well Construction Work Plan.

For effluent discharges direct to surface water or into the Municipal Separate Storm Sewer System, please contact DOEE NPDES Program at (202) 535-2600 for further instructions.

After the Well Construction Permit Application process, Dewatering Wells and other wells that may request to discharge to public sewer systems will also require additional permits such as the Temporary Discharge Authorization Permit.

Temporary Discharge Authorization Permit Application

A Temporary Discharge Authorization Permit Application through the D.C. Water and Sewer Authority – Department of Wastewater Treatment will be required if needed to discharge dewatering fluids to District combined or sanitary sewers. The Temporary Discharge Permit requires representative samples of fluids to be discharged. Samples can be collected in-situ (from monitoring wells) or the fluids can be pump to water-tight containers and then sampled. Typical parameters of interest listed in the Temporary Discharge Permit Application include:

- volatile organic compounds (VOCs) by EPA Method 624.
- semiVOC scan (EPA Method 625) (sites where petroleum contamination is known or suspected).
- polychlorinated biphenyls (PCBs), petroleum oil, and grease.
- heavy metals (arsenic, cadmium, copper, lead, mercury, and zinc).
- suspended solids, and pH.

Additional parameters may be requested based on the nature of the derived solid or liquid waste wastewater discharge or identified soil contamination.

The District of Columbia Water and Sewer Authority (DC Water) discharge permit can be found at • https://www.dcwater.com/business/permits/groundwater_temporary_discharge.cfm

13.3 Derived Material Management

13.3.1 Purpose

The construction, maintenance and abandonment of wells generate solid and liquid wastes that need to be managed. These derived wastes have the potential to originate from contaminated areas below the ground surface and contain contaminates, hazardous substances or hazardous wastes that have the potential to harm public health and safety as and the environment.

Per Well Regulation §1813.1, a Well Owner shall ensure all derived waste from the construction, maintenance, or abandonment of a well is managed and handled in accordance with Well Regulation §1800 and all District and federal laws and regulations.

13.3.2 Definitions

- Contaminant – a biological, chemical, physical, or radiological material that poses a hazard to public health and safety or the environment, or interferes with a designated or beneficial use of the District of Columbia's waters.
- Contaminated Site – A site that contains a biological, chemical, physical, or radiological material that poses a hazard to public health and safety or the environment, or interferes with a designated or beneficial use of the District of Columbia's waters.
- Derived Waste – any unwanted, or discarded material, solid, liquid, or gas, that is derived from well construction, operations, maintenance, and abandonment activities including drill cuttings, drilling fluids, mud slurries, or well decontamination, development or purge waters.
- Discharge – spilling, leaking, releasing, pumping, pouring, emitting, emptying, or dumping of any pollutant or hazardous substance, including a discharge from a storm sewer, into or so that it may enter District of Columbia waters. [Statutory]
- Drill Cuttings – any material, typically solids, removed from a borehole during drilling activities.
- Drilling Fluid – water or air-based fluid used in a well drilling operation.
- Hazardous Substance – any toxic pollutant referenced in or designated in or pursuant to § 307(a) of the Federal Water Pollution Control Act; any substance designated pursuant to § 311(b)(2)(A) of the Federal Water Pollution Control Act; or any hazardous waste having the characteristics of those identified under or listed pursuant to the District of Columbia Hazardous Waste Management Act of 1977, as amended.
- Hazardous Waste – any waste or combination of wastes of a solid, liquid, contained gaseous, or semisolid form which, because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Such wastes include, but are not limited to, those which are toxic, carcinogenic, flammable, irritants, strong sensitizers, or which generate pressure through decomposition, heat or other means, as well as containers

and receptacles previously used in the transportation, storage, use or application of the substances described as a hazardous waste.

13.3.3 Determination of Existing Site Conditions

The Well Owner and/or the Well Permit Applicant maintains the responsibility to investigate and determine the existing site conditions at the location of well construction for presence of contamination or recognized environmental conditions.

During the Well Construction Application Permit process (including the review of the Well Construction Work Plan), the Well Owner and/or the Well Permit Applicant maintains the responsibility to provide best available information regarding existing site conditions to DOEE for review and consideration.

Refer to Section 15.4 of this Well Guidance Document and Well Regulation §1803 for additional information.

13.3.4 Protection of Public Health, Safety and the Environment

Per Well Regulation §1813.3, "no person shall place, use, store, or dispose of derived waste from the construction, maintenance, or abandonment of a well in a manner that the derived waste may come into contact with or leach into the waters of the District, thereby violating the District Water Quality Standards in Chapter 11 of Title 21 of the District of Columbia Municipal Regulations (DCMR), or resulting in acute or chronic exposure to aquatic biota or otherwise posing a hazard to public health and safety or the environment."

Per Well Regulation §1813.5, "No person shall discharge the following into a separate stormwater sewer or waters of the District without obtaining applicable District and federal permits:

- Dewatering effluent;
- Groundwater treatment system effluent;
- Process water; or
- Derived waste."

13.3.5 Contaminated Sites or Sites with Recognized Environmental Conditions

Per Well Regulation §1813.2, "a Well Owner shall containerize all derived waste from the construction, maintenance, or abandonment of a well sited on a property where a recognized environmental condition has been identified and take the following measures, that are also applicable for sites with known contamination:

- Representative sample(s) of the derived waste shall be collected and analyzed for known or suspected contaminants by a National Environmental Laboratory Accreditation Conference (NELAC) certified laboratory using appropriate EPA-approved procedures such as SW-846 Test Method 1311: Toxicity Characteristic Leaching Procedure. The TCLP is designed to

determine the mobility of both organic and inorganic analytes present in liquid, solid, and multiphasic wastes.

- All derived waste shall be stored and transported in United States Department of Transportation-approved containers; and
- All derived waste shall be permanently removed from the site for disposal in accordance with all District and federal laws and regulations. Exceptions to permanent offsite disposal are for derived waste characterized to be both of the following: nonhazardous relative to EPA RCRA Subtitle C – Managing Hazardous Waste, Chapter 1; and derived wastes determined to contain regulated substances at concentrations below EPA Regional Screening Levels.

13.3.5.1 Management of Derived Solid Waste

Soil and sediment materials including drilling cuttings, spoils, and rock, etc. (i.e., derived solid waste) from well construction, maintenance, and abandonment activities at contaminated sites, sites with recognized environmental conditions or sites being investigated for such conditions require special handling and disposal requirements.

Requirements to management derived solid waste under these conditions are provided below. These requirements shall be reviewed and implemented in conjunction with the approved Well Construction Permit Application and Well Construction Work Plan (and the Well Abandonment Work Plan and Report as applicable) as approved by DOEE.

1. Generation and Handling Activities derived solid waste generated on-site during the construction, maintenance and abandonment of a well are presumed to be contaminated if the site has been determined to contain known or suspected contaminants.
   (a) Materials shall be segregated from non-contaminated materials on-site.
   (b) Materials shall be stored on a protective sheeting to prevent contact with the ground surface and covered with an additional protective sheeting to prevent contact with precipitation until the materials can be stored in 55-gallon drums. Alternatively, materials can be stored directly in 55-gallon drums (with securable lips) that are to be placed on pallets with drum covers and secured together with tie-down mechanisms. These activities shall occur during the work day and at the completion of the work day.
   (c) Materials and/or 55-gallon drums shall be provided secondary containment such as a 6-inch to 1-foot berm constructed of non-contaminated material or other berm materials around the stockpile for containment and to prevent contact with surface water flow. For drums, a secondary containment pallet is also acceptable. These activities shall occur during the work day and at the completion of the work day.
   (d) Materials from different wells may be combined provided they are associated with the same aquifer and eventual disposal site.
   (e) Visual evidence of contamination consisting of discoloration, sheens, free product or NAPL or olfactory evidence of contamination shall be recorded by on-site representatives.
2. Labeling derived solid waste that is stockpiled and covered or in 55-gallon drums shall have appropriate signage or labels for investigation-derived solid waste.

(a) Material type, date of generation, location, company name and contact person with phone number shall be listed.

3. Sampling and Analysis Activities derived solid waste shall be sampled and analyzed for known or suspected contaminated.

(a) Sampling shall occur on the day of material generation (i.e., the day the well was being constructed, maintained or abandoned, as applicable).

(b) Sampling is required to ensure proper classification, treatment and disposal of contaminated materials or materials classified as hazardous waste.

(c) Sampling is required to determine if the derived solid waste is a RCRA classified characteristic hazardous waste. Sample results are to be compared to RCRA Subpart C – Characteristics of Hazardous Waste Table 1 – Maximum Concentration of Contaminants for the Toxicity Characteristic. Samples are to be analyzed as follows (or most recent version):

i. Ignitability by EPA Method SW846 1020,
ii. Corrosivity as pH by EPA Method SW846 CHAP7,
iii. Reactivity by EPA SW847 CHAP7,
iv. Toxicity Characteristic Leaching Procedure (TCLP) Metals by EPA SW846 1311/6010C and 1311/7470A,
v. TCLP Volatile Organic Compounds by EPA SW846 1311/8260C,
vi. TCLP Semi-Volatile Organic Compounds by EPA SW846 1311/8270D,
vii. TCLP Herbicides by EPA SW846 1311/8151A,
viii. TCLP Pesticides by EPA SW846 1311/8081

(d) Sampling is also required to determine if the derived solid waste contains regulated substances at concentrations below EPA Regional Screening Levels (RSLs). RSL Target Cancer Risk (TR) of 1E-06 and Target Hazard Quotient (THQ) of 0.1 will be used for residential sites and THQ of 1.0 will be used for Industrial Sites. Specific analyses are dependent on the REC, known or suspected contaminant. Typical analyses may include the following:

i. Polychlorinated biphenyls (PCBs) by EPA Method 8082,
ii. Metals (RCRA-8) by EPA Methods 6010 and 7470,
iii. Volatile Organic Compounds (Target Compound List) by EPA SW846 8260C,
iv. Semi-Volatile Organic Compounds (Target Compound List) by EPA SW846 8270D,

(e) DOEE specifically request derived wastes to be analyzed for Total Petroleum Hydrocarbons (TPH) by EPA Method 8015B (both Diesel Range Organics and Gasoline Range Organics). The TPH threshold of 100 parts per million (sum of TPH) will be used to determine if the derived solid waste is required to be disposed of offsite.

(f) Analysis Reports with narrative descriptions of analysis results shall be provided with the Well Completion Report.

4. Reporting Activities following sampling and analysis, all applicable and required reports shall be submitted to DOEE prior to any on-site disposal of derived waste.

(a) Derived waste is not permitted for placement or infiltration at a contaminated site.

(b) Only uncontaminated derived waste may be permitted for placement or infiltration at an uncontaminated site.

5. Disposal Activities following the analysis results and reporting, guidance shall be provided from DOEE regarding proper disposal of the derived solid waste.

   (a) Derived solid waste identified as contaminated, containing hazardous substances or characterized as hazardous waste may be temporarily stored on the site in a secure area (with secondary containment) awaiting disposal, in accordance with applicable EPA and DOEE's waste management regulations.

   (b) Derived solid waste identified as contaminated, containing hazardous substances or characterized as hazardous waste shall be disposed of at a properly licensed and regulated disposal facility.

   (c) Derived solid waste identified as contaminated, containing hazardous substances or characterized as hazardous waste shall be transported by a properly licensed and regulated hauler.

   (d) Documentation regarding the proper disposal of derived solid waste and quantities (such as weigh tickets, chain of custodies, manifests, and invoices, etc.) shall be provided to the District as documentation of completed activities.

Derived solid waste that is not identified as contaminated, containing hazardous substances or characterized as hazardous waste shall be managed in accordance with Section 16.6 of this Well Guidance Document, DOEE approved Well Construction Permit Application and Well Construction Work Plan (and the Well Abandonment Work Plan and Report as applicable) and Well Regulation §1813.4.

13.3.5.2 Management of Derived Liquid Waste

Liquid materials including dewatering effluent; groundwater treatment system effluent; process water, decontamination water, well development water, purge water, dewatering effluent, drilling fluids and mud slurries, etc. (i.e., derived liquid waste) from well construction, maintenance, and abandonment activities at contaminated sites, sites with recognized environmental conditions or sites being investigated for such conditions require special handling and disposal requirements.

Requirements to management derived liquid waste under these conditions are provided below. These requirements shall be reviewed and implemented in conjunction with the approved Well Construction Permit Application and Well Construction Work Plan (and the Well Abandonment Work Plan and Report as applicable) as approved by DOEE.

1. Generation and Handling Activities derived liquid waste generated on-site during the construction, maintenance and abandonment of a well are presumed to be contaminated if the site has been determined to contain known or suspected contaminants.

   (a) Materials shall be containerized on-site immediately upon generation.

   (b) Materials shall be containerized in 55-gallon drums with securable lids and placed on pallets, with drum covers and secured together with tie-down mechanisms. These activities shall occur during the work day and at the completion of the work day.

(c) Materials in 55-gallon drums shall be provided secondary containment such as a 6-inch to 1-foot berm constructed of non-contaminated material to prevent contact with surface water flow. A secondary containment pallet is also acceptable. These activities shall occur during the work day and at the completion of the work day.

(d) Materials from different wells may be combined provided they are associated with the same aquifer and eventual disposal site.

(e) Visual evidence of contamination consisting of discoloration, sheens, free product or NAPL or olfactory evidence of contamination shall be recorded by on-site representatives.

(f) If evidence of non-aqueous phase liquid (NAPL) or sheen is observed or known to be present in the containerized derived liquid waste, qualified field personnel may remove and transfer the NAPL to another 55-gallon drum container. A spill containment kit must be on-site and NAPL shall never be released to the ground. The NAPL may be removed by a skimmer, absorbent pads or decanted and containerized and labeled separately.

2. Labeling derived solid waste that is stockpiled and covered or in 55-gallon drums shall have appropriate signage or labels for investigation-derived solid waste.

(a) Material type, date of generation, location, company name and contact person with phone number shall be listed.

3. Liquid waste derived from sampling and analysis activities shall be sampled and analyzed for known or suspected contamination.

(a) Sampling shall occur on the day of material generation (i.e., the day the well was being construction, maintained or abandoned as applicable).

(b) If NAPL is removed and transferred into a separate 55-gallon drum container, the container with the residual decanted water still requires sampling, analysis and proper labeling.

(c) Sampling is required to ensure proper classification, treatment and disposal of contaminated materials or materials classified as hazardous waste.

(d) Sampling is also required to determine if the derived liquid waste contains regulated substances at concentrations below EPA Maximum Contaminant Levels (MCLs). Specific analyses are dependent on the REC, and known or suspected contaminant. Typical analyses may include the following:

i. Polychlorinated biphenyls (PCBs) by EPA Method 8082;
ii. Metals (RCRA-8) by EPA Methods 6010 and 7470;
iii. Volatile Organic Compounds (Target Compound List) by EPA SW846 8260C;
iv. Semi-Volatile Organic Compounds (Target Compound List) by EPA SW846 8270D;

(e) DOEE specifically request derived wastes to be analyzed for Total Petroleum Hydrocarbons (TPH) by EPA Method 8015B (both Diesel Range Organics and Gasoline Range Organics). The TPH threshold of 1.0 parts per million (sum of TPH) will be used to determine if the derived liquid waste is required to be disposed of offsite.

(f) Analysis Reports with narrative descriptions of analysis results shall be provided with the Well Completion Report.

4. Reporting Activities following sampling and analysis, all applicable and required reports shall be submitted to DOEE prior to any on-site disposal of derived waste.
   (a) Derived waste is not permitted for placement or infiltration at a contaminated site.
   (b) Only uncontaminated derived waste may be permitted for placement or infiltration at an uncontaminated site.
5. Disposal Activities following the analysis results and reporting, guidance shall be provided from DOEE regarding proper disposal of the derived liquid waste.
   (a) Derived liquid waste identified as contaminated, containing hazardous substances or characterized as hazardous waste may be temporarily stored on the site in a secure area (with secondary containment) awaiting disposal, in accordance with applicable EPA and DOEE waste management regulations.
   (b) Derived liquid waste identified as contaminated, containing hazardous substances or characterized as hazardous waste shall be disposed of at a properly licensed and permitted pretreatment, treatment or disposal facility.
   (c) Derived liquid waste identified as contaminated, containing hazardous substances or characterized as hazardous waste shall be transported by a properly licensed and regulated hauler.
   (d) Documentation regarding the proper disposal of derived liquid waste and quantities (such as weigh tickets, chain of custodies, manifests, and invoices, etc.) shall be provided to the District as documentation of completed activities.

Derived liquid waste that is not identified as contaminated, containing hazardous substances or characterized as hazardous waste shall be managed in accordance with Section 15.6 of this Well Guidance Document, DOEE approved Well Construction Permit Application, and Well Construction Work Plan and the Well Abandonment Work Plan and Report as applicable) and Well Regulation §1813.6.

13.3.6 Non-Contaminated Sites

13.3.6.1 Management of Non-Contaminated Derived Solid Waste

A person may include in a Well Construction Permit Application, and Well Construction Work Plan request for approval of the placement of solid waste derived from the construction, maintenance, or abandonment of a well on the ground surface.

The Well Construction Permit Application and Well Construction Work Plan (and the Well Abandonment Work Plan and Report as applicable) shall include details of how the solid derived waste will be managed on-site or stockpiled, including: proper grading to prevent surface water ponding, stabilization, and erosion and sedimentation control measures.

Per Well Regulation §1813.4, soil or sediment derived from the construction, maintenance, or abandonment of a well may be placed on the site or stockpiled, provided it meets the following requirements.

Soil and sediment includes drilling cuttings, spoils, and rock, etc. removed from a well or borehole.

The soil or sediment is characterized as non-hazardous waste in accordance with Section 16.5, 16.5.1 of this Well Guidance Document, and does not pose a hazard to public health and safety and the environment;

The soil or sediment contains a concentration of total petroleum hydrocarbons (TPH) of less than one hundred parts per million (100 ppm); and

The soil and sediment stockpile or placement complies with the District's erosion and sediment control requirements in Chapter 5 of Title 21 DCMR.

13.3.6.2 Management of Non-Contaminated Derived Liquid Waste

Per Well Regulation §1813.6, a person may include either in a Well Construction Permit Application, or in a Well Construction Work Plan, request for approval of the placement of fluid waste derived from the construction, maintenance, or abandonment of a well, on the ground surface or in an unlined pit provided the requirements below are met.

The Well Construction Permit Application and Well Construction Work Plan (and the Well Abandonment Work Plan and Report as applicable) shall include details of how the liquid derived waste will be managed on-site, including: methods to contain and control flow to prevent erosion and sedimentation runoff, overflows and other conditions that would cause the liquid to migrate off-site.

- "Representative analytical data indicates compliance with the District Water Quality Standards in Chapter 11 of Title 21 DCMR and all other applicable federal standards or regulations;
- The fluid waste is free of solids;
- The fluid waste does not have an observable sheen or free product;
- The fluid waste is characterized in accordance with Section 16.5 and 16.5.2, and has a total petroleum hydrocarbons (TPH) concentration of less than one part per million (1 ppm); and
- The fluid waste meets the following infiltration requirements:
- Erosion and sediment control requirements in Chapter 5 of Title 21 DCMR;
- Does not create surface ponding;
- Does not discharge onto an adjacent property, a nearby surface water body, or stormwater sewer; and
- Does not create or constitute a public nuisance or a hazard to the public health and safety, and the environment."

13.3.6.3 Discharges of Derived Wastes – Permit Required

Per Well Regulation §1813.5, no person shall discharge the following derived liquid waste into a separate stormwater sewer or waters of the District without obtaining applicable District and federal permits: dewatering effluent; groundwater treatment system effluent; process water; or derived waste. These requirements would also be applicable to: decontamination water, well development water, purge water, dewatering effluent, drilling fluids and mud slurries.

The discharge of derived solid waste such as soil, sediment, drill cuttings, spoils and rock, etc. is not permitted. For more detailed information, refer to Section 15.6 of this Well Guidance Document.

13.4 Decontamination

13.4.1 Purpose

Decontamination procedures are used to remove or neutralize contaminants that have accumulated on personnel, samples, tools or equipment and to ensure the protection of personnel from permeating substances, chemicals, and infectious agents.

Decontamination reduces or eliminates transfer of these contaminants to clean areas and prevents the mixing of incompatible substances. Various decontamination methods will physically remove, inactivate by chemical detoxification, disinfection, sterilization, or remove contaminants by both physical and chemical means. In many cases, gross contamination can be removed by physical means. The following practices are compiled from EPA and general industry practices for decontamination of drilling equipment at sites where contamination is known or suspected. Decontamination at sites not known to contain chemical, biological or radiological contaminants

13.4.2 Definitions

- Contaminant – a biological, chemical, physical, or radiological material that poses a hazard to public health and safety or the environment, or interferes with a designated or beneficial use of the District of Columbia's waters.
- Contaminated Site – A site that contains a biological, chemical, physical, or radiological material that poses a hazard to public health and safety or the environment, or interferes with a designated or beneficial use of the District of Columbia's waters.
- Decontamination – the process of removing or neutralizing contaminants that have accumulated on personnel and equipment. Preventing the spread of contamination within a site and to or from offsite locations.

13.4.3 Determination of Existing Site Conditions

The Well Owner and the Well Permit Applicant maintains the responsibility to investigate and determine the existing site conditions at the location of well construction for presence of contamination or recognized environmental conditions.

During the Well Construction Application Permit process (including the review of the Well Construction Work Plan), the Well Owner and the Well Permit Applicant maintains the responsibility to provide best available information regarding existing site conditions to DOEE for review and consideration.

Refer to Section 15.4 Contaminant Assessments of this Well Guidance Document and Well Regulation §1803 for additional information.

13.4.4 Methods

Typical cleaning methods work by either dissolution or by forcing the contaminant off a surface with pressure. Refer to EPA Operating Procedure – Field Equipment Cleaning and Decontamination (SESDPROC-025-R3) or ASTM D5088-15a – Standard Practice for

Decontamination of Field Equipment at Nonradioactive Waste Sites. A list of approved decontamination materials and methods follows:

- High-Pressure Water – using a high-pressure pump, an operator controlled directional nozzle, and high-pressure hose. Operating pressure usually ranges from 340 to 680 psig, which relates to flow rates of 20 to 140 lpm (liters per minute).
- Steam Cleaning – using water delivered at high pressure and high temperature in order to remove accumulated solids or oils.
- Mechanical – using brushes with metal, nylon, or natural bristles or utilizing appropriate tools to scrape, pry, or otherwise remove adhered materials.
- Dissolving – using chemicals to dissolve surface contaminants as long as the solvent is compatible with the equipment and protective clothing. Organic solvents include alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products. Halogenated solvents are generally incompatible with protective clothing and are toxic.
- Detergent – using a detergent reduces adhesion forces between contaminants and the surface that is being cleaned, and prevents reposition of the contaminants. Non-phosphate detergents dissolved in tap water is an acceptable surfactant solution.
- Disinfection and Sterilization – using chemical disinfectants to inactivate infectious agents. Standard sterilization methods are impractical for large equipment and personal protective clothing.

13.4.5 Materials

The following are standard materials and equipment that may be used as a part of the decontamination process:

- Appropriate protective clothing;
- Paper towels;
- Drop cloths (plastic sheeting);
- Aluminum foil;
- Non-phosphate soap or detergent;
- Long-handled brushes;
- Galvanized tubs or equivalent (baby pools);
- Tap water (from a known potable water source);
- Contaminant-free distilled or deionized water;
- Pressurized sprayers and water;
- Pressurized sprayers and solvents;
- Steam cleaning equipment;
- Emergency eyewash bottle;

- Safety glasses or splash shield;
- Sample containers;
- Trash containers;
- Trash bags; and
- Metal or plastic container for storage and disposal of contaminated wash solutions.

13.4.6 Contact Minimization Procedures

Several procedures can be established to minimize contact with waste and the potential for contamination including:

- Employing work practices that minimize contact with contaminated media (avoid areas of obvious contamination, avoid touching contaminated media).
- Acquire and review Safety Data Sheets (SDSs, formerly known as Material Safety Data Sheets or MSDSs) of decontamination solutions for incompatibilities with site contaminants, skin or inhalation hazards, or flammable properties.
- A specified area will either be available or can be constructed where fluids generated during decontamination can be fully captured for disposal.
- Use of remote sampling, handling, and container-opening techniques.
- Covering monitoring and sampling equipment with plastic or other protective material.
- Use of disposable outer garments and disposable sampling equipment with proper containment of these disposable items.
- Use of disposable towels to clean the outer surfaces of sample bottles before and after sample collection.
- Encasing the source of contaminants with plastic sheeting or over packs.
- Avoid decontamination chemicals/solutions that permeate, degrade, or damage personal protective equipment.
- Adhere to all Federal, State, and local agency laws, codes, and regulations when handling, transporting, and storing of wastewater, drilling fluids and decontamination fluids.
- The material being removed from drill sites must be packaged, moved, stored, treated, and disposed of in a manner that prevents its release into the environment.
- Drums and containers used to transport drilling waste will meet the appropriate US Department of Transportation (DOT), OSHA, and EPA regulations for the materials that they contain. Appropriate manifest and chain of custody documentation should be used and the waste generator should maintain records as required by applicable regulations.
- Drums and containers used to contain and store drilling wastes and other hazardous materials must be appropriately labeled in accordance with federal and state regulations.
- Drums and containers will be inspected as required by regulations.
- Drum and container integrity will be assured prior to being moved.

- If leakage or spillage occurs, it will be cleaned up immediately. If necessary, the waste material will be transferred to another container to minimize leakage and appropriate measures taken to prevent reoccurrence.
- The drums will have exterior contamination removed at the worksite prior to transportation.

13.4.7 Decontamination Procedures at Contaminated Sites

13.4.7.1 Heavy Equipment Decontamination at Contaminated Sites

Cleaning and decontamination of all drilling equipment that is directly over the borehole and heavy machinery (back-hoe bucket) that may contact contaminated soil or sediment should occur at a designated area (decontamination pad) on the site. The decontamination pad should meet the specifications of this Section. Tap water brought on the site for drilling and cleaning purposes should be contained in a pre-cleaned tank. A steam cleaner and/or high pressure hot water washer capable of generating a pressure of at least 2500 PSI and producing hot water and/or steam, with a detergent compartment, should be utilized.

The following steps will be used when decontaminating drilling equipment that is over the borehole (Kelly bar, mast, drilling platform, hoist, chain pulldowns, etc.) and heavy machinery (back-hoe bucket) that has come into contact with contaminated materials:

- Establish a centralized decontamination area or pad (e.g.; large troughs or plastic sheeting with temporary wood bermed sides) that is large enough to fully contain the equipment to be cleaned. All contamination areas must be upwind of the area under investigation.
- With the heavy equipment in place, spray areas (rear of rig and tower) exposed to contaminated media using a hand-handle sprayer, taking care to spray down all surfaces that contact soil or fluids.
- Use brushes, apply phosphate-free soap, and potable water steam cleaner to remove dirt whenever necessary.
- Remove equipment from the decontamination area and allow it to air dry before returning it to the work site. If removal of the equipment requires lowering of the wooden berm, waste fluids and other waste materials must not be allowed to escape the decontamination area.
- After decontamination activities are completed, collect all contaminated wastewater, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles (i.e., solids and liquids). A decontamination area may be used for multiple day/weeks provided the containment integrity is maintained. All receptacles containing contaminated items must be properly labeled for disposal. Liquids must be separated from solids and drummed.

13.4.7.2 Downhole Equipment Decontamination at Contaminated Sites

Drilling equipment should be clean of any contaminants that may have been transported from off-site to minimize the potential for cross-contamination. The drilling equipment should not serve as a source of contaminants. Associated drilling and decontamination equipment, well

construction materials, and equipment handling procedures should meet these minimum specified criteria:

- All downhole augering, drilling, and sampling equipment should be sandblasted before use if painted, and/or there is a buildup of rust, hard or caked matter, etc., that cannot be removed by steam cleaning (detergent and high pressure hot water), or wire brushing. Sandblasting should be performed prior to arrival on site, or well away from the decontamination pad and areas to be sampled.
- Any portion of the drilling equipment that is over the borehole (kellybar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (detergent and high pressure hot water) and wire brushed (as needed) to remove all rust, soil, and other material which may have come from other sites before being brought on site.
- Printing and/or writing on well casing, tremie tubing, etc., should be removed before use. Emery cloth or sand paper can be used to remove the printing and/or writing. Most well material suppliers can provide materials without the printing and/or writing if specified when ordered. Items that cannot be cleaned are not acceptable and should be discarded.
- Equipment associated with the drilling and sampling activities should be inspected to insure that all oils, greases, hydraulic fluids, etc., have been removed, and all seals and gaskets are intact with no fluid leaks

Downhole equipment includes cutting shoe, augers, rods, stems, etc. Follow these steps when decontaminating downhole equipment that has come in contact with contaminated materials:

- Establish a centralized decontamination area (e.g.,, large trough of plastic bermed area), if possible. This area shall be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.
- Wash with tap water and phosphate-free detergent, using a brush if necessary, to remove particulate matter and surface films. Steam cleaning (high pressure hot water with detergent) may be necessary to remove matter that is difficult to remove with the brush. Drilling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. Hollow-stem augers, drill rods, etc., that are hollow or have holes that transmit water or drilling fluids, should be cleaned on the inside with vigorous brushing.
- Apply dissolving or disinfection solution if necessary based on contaminant encountered.
- Rinse the equipment using clean, potable water from a known source.
- Remove the equipment from the decontamination area and place in a clean area upwind to air dry.
- After decontamination activities are completed, collect all contaminated wastewaters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles (i.e., solids and liquids).

All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, containerized (55-gallon drums), labeled, marked, stored, and disposed of as investigation-derived waste. Small quantities of decontamination solutions may be allowed to evaporate to dryness. Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, nonhazardous waste and placed in trash bags for disposal. Waste liquids shall be sampled, analyzed for contaminants of concern in accordance with disposal regulations, and disposed of accordingly.

13.4.7.3 Prevention of Cross-Contamination

To prevent cross-contamination, heavy equipment and down-hole equipment used either at a contaminated site, at a site with a recognized environmental condition, or at a site under investigation, shall be decontaminated every time, prior to commencing well-installation activities in a different well. Refer to Sections 16.7.1 and 16.7.2 of this Well Guidance Document for more detailed information.

13.4.8 Cleaning Procedures at Non-Contaminated Sites

13.4.8.1 Heavy Equipment Cleaning at Non-Contaminated Sites

Heavy equipment (i.e., drilling rigs and vehicles) should arrive to the site clean and without accumulated dirt or sediment that originated from another site. Drilling rigs and vehicles that come in contact with site dirt, drill cuttings and fluids at non-contaminated sites should be sprayed down with potable water with a hand held sprayer to remove accumulated materials. Collection and containment of spray water and removed accumulated materials is not required. However, the waste materials must not be allowed to pond, discharge offsite or to the stormwater system or a surface water body. Further, any disturbance of sediment at a site must be in compliance with the District's Stormwater Regulations (21 DCMR 5).

13.4.8.2 Downhole Equipment Cleaning at Non-Contaminated Sites

Downhole equipment includes augers, rods, stems, etc. Follow these steps when cleaning this equipment:

- Using phosphate-free detergent and potable water wash the equipment using hand-held sprayers. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.
- Rinse the equipment using clean, potable water.
- Place washed equipment in a clean area upwind to air dry.

13.4.9 Prevention of Off-Site Sediment Deposition

To prevent the off-site deposition of sediment and other debris from well construction, maintenance, and abandonment activities, the wheels of heavy equipment and vehicles shall be pressure washed or rinsed prior to leaving the site. Other areas of heavy equipment and vehicles

that the potential to deposit sediment off-site shall also be pressure washed or rinsed prior to leaving the site.

These activities shall be performed in accordance with the requirements of the Well RegulationRegulations, the Well Construction Permit Application and Well Construction Work Plan (and Well Abandonment Work Plans and Reports, as applicable), the District's erosion and sediment control requirements in Chapter 5 of Title 21 DCMR, and the District's water pollution control requirements Per DC Law §8-103, the Water Pollution Control Act, and Title 8 of the DC Code for Water Pollution Control.

Resources and References

The following list of Existing Resources is provided to guide Well Owners and Well Permit Applicants to potential information sources that may assist them the requirements of the Well Regulations.

It is the intention that these Existing Resources are provided exclusively for informational purposes only and that the Well Owner or Well Permit Applicant maintains the primary responsibility for compliance with the requirements of the Well Regulations.

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District of Columbia, Map of Known Wetlands and Waterbodies, Department of the Environment, Water Quality Division, Wetland Conservation Plan 1997. http://doee.dc.gov/publication/map-known-wetlands-within-district-columbia

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Fleming, A.H., Drake. A.A., Jr., and McCartan, Lucy, 1994, Geologic Map of the Washington West quadrangle, District of Columbia, Montgomery and Prince Georges Counties, Maryland, and Arlington and Fairfax Counties, Virginia: U.S. Geological Survey Geologic Quadrangle Map GQ-1748, scale 1:24,000. http://ngmdb.usgs.gov/Prodesc/proddesc_277.htm

Johnston, P.M., 1964, Geology and Groundwater Resources of Washington, D.C. and vicinity: U.S. Geological Survey Water-Supply Paper 1776, 98 p. https://pubs.er.usgs.gov/publication/wsp1776

Khloe, C.A., and Debrewer, L.M., 2007, Summary of ground-water quality data in the Anacostia River Watershed, Washington, D.C. September – December 2005: U.S. Geological Survey Open-File Report 2006-1392, 64 p.

Southworth, S., and Denenny, D., 2006, Geologic Map of the National Parks in the National Capital Region, Washington, D.C., Virginia, Maryland and West Virginia: U.S. Geological Survey Open-File Report 2005-1331. http://pubs.usgs.gov/of/2005/1331/

Reference Documents

The following list of Reference Documents was used to prepare the Well Guidance Document.

American Society for Testing and Materials (ASTM) standards as referenced in the Well Guidance Document and in DCMR Title 21, Chapter 18 Well Construction, Maintenance, and Abandonment Standards.

District of Columbia Department of Energy and Environment – submission of well permit documents. well.permits@dc.gov.

District of Columbia Department of Transportation – online permitting system. https://tops.ddot.dc.gov/DDOTPERMITSYSTEM/DDOTPERMITONLINE/Landing.aspx.

District of Columbia Government Freedom of Information Act (FOIA) – public access website. https://foia-dc.gov/palMain.aspx.

District of Columbia Municipal Regulations, Department of Energy and Environment, Title 21 Water and Sanitation, Chapter 18 – Well Construction, Maintenance, and Abandonment Standards, as promulgated on October 28, 2016.

District of Columbia Water and Sewer Authority – discharge permit website. https://www.dcwater.com/business/permits/groundwater_temporary_discharge.cfm.

Occupational Safety & Health Administration (OSHA) – Decontamination. https://www.osha.gov/SLTC/hazardouswaste/training/decon.html. July 2016.

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Definitions

The definitions below are from contained herein are referenced in 21 DCMR § 1899. When used in 21 DCMR §§ 1800-1899 and in this guidance document, the following terms shall have the meanings ascribed (definitions that are codified in the relevant acts are indicated as [Statutory], and are reprinted below for regulatory efficiency).

Abandonment – the act of properly sealing a well.

Annulus – the space between two cylindrical objects one of which surrounds the other, such as the space between a drill hole and a well casing pipe or between two well casings.

Aquifer – a geologic unit or formation that is water bearing and yields water.

Aquifer Cross-Contamination – a condition in which contaminates have migrated from one aquifer to another via any hydraulic connection or hydraulic mechanism.

ASTM – the American Society for Testing Materials.

Casing – the pipe or tubing, constructed of specific materials with specified dimensions and weights, which is installed in a borehole during or after completion of a well, to prevent formation material from entering the well, and to prevent entry of undesirable substances into the well.

Closed-Loop Ground Source Heat Pump System – a ground source heat pump system that utilizes closed-loop ground source heat pump wells.

Closed-Loop Ground Source Heat Pump Well (GSHP) – a well in which fluid is circulated in a continuous closed-loop fluid system, installed beneath the surface of the earth or in a medium where the system can obtain sufficient cooling or heat exchange.

Confined Aquifer – an aquifer bounded above and below by confining units.

Confining Unit – a body of impermeable or distinctly less permeable material above or below an aquifer.

Consolidated Formation – any geologic formation in which the earth materials have become firm and coherent through natural rock forming processes.

Contaminant – a biological, chemical, physical, or radiological material that poses a hazard to public health and safety or the environment, or interferes with a designated or beneficial use of the District of Columbia's waters.

DCRA – the District of Columbia Department of Consumer and Regulatory Affairs.

Department – the Department of Energy and Environment (DOEE).

Department Regulatory Action – a Department action(s), including remedial or removal actions, performed under the Voluntary Remedial Action Program, pursuant to Section 6213 of Title 20 of the District of Columbia Municipal Regulations (DCMR); the District of Columbia Underground Storage Tank Management Act of 1990, as amended, D.C. Official Code §§ 8-113.01 et seq., and its implementing regulations in Chapters 55-70 of Title 20 DCMR; the Voluntary Cleanup Program, pursuant to D.C. Official Code §§ 8-633.01 et seq.; or the

District of Columbia Brownfield Revitalization Amendment Act of 2000, as amended; D.C. Official Code §§ 8-631 et seq.

Derived Waste – any unwanted, or discarded material, solid, liquid, or gas, that is derived from well construction, operations, maintenance, and abandonment activities including drill cuttings, drilling fluids, mud slurries, or well decontamination, development, or purge waters.

Dewatering Well – a well-used to lower groundwater levels for the construction of structures such as for footings, sewer lines, building foundations, elevator shafts, or parking garages.

Discharge – spilling, leaking, releasing, pumping, pouring, emitting, emptying, or dumping of any pollutant or hazardous substance, including a discharge from a storm sewer, into or so that it may enter District of Columbia waters. [Statutory]

District – the District of Columbia. [Statutory]

Domestic Supply Well – a water supply well used for potable water supply purposes, including drinking, bathing, showering, cooking, dishwashing, and maintaining oral hygiene.

Drill Cuttings – any material, typically solids, removed from a borehole during drilling activities.

Drilling Fluid – water or air-based fluid used in a well drilling operation.

EPA – the United States Environmental Protection Agency.

Filter Pack – clean, well-rounded, smooth, uniform sand or gravel, which is placed in the annulus of the well between the borehole wall and the well screen to prevent formation material from entering the well.

Floodplain – a relatively flat or low land area which is subject to partial or complete inundation from an adjoining or nearby stream, river, or watercourse; or any area subject to the usual and rapid accumulation of surface waters from any source; as depicted in the Flood Insurance Rate Map and Flood Insurance Study for the District prepared by the Federal Emergency Management Agency.

Formation – a distinct assemblage of earth materials, consolidated or unconsolidated, grouped together into a unit that is convenient for description or mapping.

Gravel – any loose rock that is larger than two millimeters (2 mm).

Ground Freeze Well – a well that is constructed for the installation of subsurface freeze pipes designed to freeze the surrounding soil and groundwater to increase their combined strength and create an impervious strata; ground freezing is typically used for construction of shafts, deep excavations, tunnels, groundwater control, structural underpinning, and containment of hazardous waste.

Ground Source Heat Pump System – a mechanical system for heating and cooling that utilizes the naturally occurring ambient ground temperature and the transfer of thermal energy to or from the earth.

Groundwater – naturally occurring underground water. Not the water in (or leaking from) pipes, tanks, and other containers created or set up by people.

Grout – any stable, impervious, bonding material, reasonably free of shrinkage, which is capable of providing a water-tight seal in the annular spaces of a well.

Hazardous Substance – any toxic pollutant referenced in or designated in or pursuant to § 307(a) of the Federal Water Pollution Control Act; any substance designated pursuant to § 311(b)(2)(A) of the Federal Water Pollution Control Act; or any hazardous waste having the characteristics of those identified under or listed pursuant to the District of Columbia Hazardous Waste Management Act of 1977, as amended.

Hazardous Waste – any waste or combination of wastes of a solid, liquid, contained gaseous, or semisolid form, which because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Such wastes include, but are not limited to, those which are toxic, carcinogenic, flammable, irritants, strong sensitizers, or which generate pressure through decomposition, heat or other means, as well as containers and receptacles previously used in the transportation, storage, use or application of the substances described as a hazardous waste.

Industrial Supply Well – a non-potable water supply well used to supply water to an industrial or commercial facility for use in the production of goods and services.

Infiltration Test – any method used to measure the rate that stormwater may move vertically through the soil profile.

Infiltration/Exfiltration Well – below ground surface device primarily used to detain stormwater runoff before allowing it to infiltrate the device's sidewalls and bottom prior to treatment and release to the surrounding soil.

Injection Well – a well through which liquid or gas is injected, under pressure or gravity flow, into the subsurface for the purpose of maintaining formation pressure, recharging the aquifer, or the treatment of contaminants.

Installation – any structure, equipment, facility, or appurtenances thereto, operation, or activity which may be a source of pollution.

Irrigation Supply Well – a non-potable water supply well used for irrigating land, crops, or other plants other than household lawns and gardens.

Licensed Well Driller – a person licensed by a state or federal district to be responsible for on-site work relating to the drilling, construction, development, testing, maintenance or abandonment of a well; well rehabilitation and repair; and the installation, modification, or repair of a well pump or related equipment.

Lot – measured tract of land with specific boundaries (lot) which information is maintained on the records of the Surveyor of the District of Columbia.

Maintenance – any action undertaken to prevent the deterioration of a well from its original permitted and registered specifications, or any action undertaken to restore a well to its original permitted and registered specifications, enabling a well to operate according to its intended use.

Modification – the alteration or rework of a well involving a material change in the original permitted design or construction, including but not limited to deepening, increasing the diameter, casing, perforating, and screen removal.

Monitoring Well – a well installed for the sole purpose of assessing subsurface conditions and collecting groundwater samples.

Multi-Layer Aquifer – an aquifer containing unconsolidated units of varying permeability or zones bound by confining units.

Non-Point Source – any source from which pollutants are or may be discharged other than a point source.

Observation Well – a well that is used for the sole purpose of determining groundwater levels.

Open-Loop Ground Source Heat Pump System – a ground source heat pump system that withdraws groundwater from a well for use in the heat exchange unit of the system and then discharges the groundwater to the aquifer via a return well or standing column well or to a surface water body.

Person – any individual, including any owner or operator as defined in this chapter; partnership; corporation, including a government corporation; trust association; firm; joint stock company; organization; commission; the District or federal government; or any other entity. [Statutory]

Piezometer – a non-pumping, non-potable well used for measuring groundwater levels or potentiometric surface.

Point Source – any discrete source of quantifiable pollutants, including but not limited to a municipal treatment facility discharge, residential, commercial or industrial waste discharge or a combined sewer overflow; or any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. [Statutory]

Pollutant – any substance which may alter or interfere with the restoration or maintenance of the chemical, physical, radiological, and biological integrity of the waters of the District; or any dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemicals, chemical wastes, hazardous wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, oil, gasoline and related petroleum products, and industrial, municipal, and agricultural wastes. [Statutory]

Potable – water that is free from impurities in amounts sufficient to cause disease or harmful physiological effects and that conforms with the National Primary Drinking Water Standards as listed in 40 C.F.R. § Part 141.

Potentiometric Surface – a surface representing the hydraulic head of ground water, represented by the water-table altitude in an unconfined aquifer or by the altitude to which water will rise in a properly constructed well in a confined aquifer.

Pressure Grouting – a process by which grout is confined within the borehole or casing and by which sufficient pressure is applied to drive the grout into and within the annular space or zone to be grouted.

Property Owner – a person listed as the legal titleholder of record of real property.

Purge – the act of removing groundwater from a well to collect groundwater samples that are representative of aquifer conditions, commonly accomplished by using a pump, prior to

collecting accurate, reproducible, and representative groundwater samples for field and/or laboratory analysis.

Recognized Environmental Condition – the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property due to any release to the environment, under conditions indicative of a release to the environment or, under conditions that pose a material threat of future release to the environment. The term includes hazardous substances or petroleum products even under conditions in compliance with laws and regulations.

Recovery Well – a well that is used to withdraw groundwater for disposal or treatment of contaminants contained within the groundwater.

Remediation – an activity performed with the intent to recover, dispose of, clean up, or treat pollutants or contaminants.

Sanitary Protection – any means of protecting groundwater from contaminants from entering a well.

Separate Stormwater Sewer – a system of pipes or other conduits, including road drainage systems, catch basins, curbs, gutters, ditches, man-made channels, and storm drains, used to convey untreated stormwater directly to waters of the District and not part of a combined or sanitary sewer systems.

Site – a tract, lot, or parcel of land, or a combination of tracts, lots, or parcels of land for which development is undertaken as part of a unit, sub-division, or project.

Sodium-Based Bentonite – a plastic, colloidal clay derived from volcanic ash consisting of at least eighty-five percent (85%) montmorillonite, with an ability to absorb fresh water and swell in volume.

Soil Boring – a well that is constructed without the installation of a well casing, well screen, or the placement of other construction materials down hole, for the purpose of determining the physical or chemical characteristics of soil or groundwater.

Standard Dimension Ratio (SDR) – the quotient obtained when the outside diameter of thermoplastic well casing is divided by the wall thickness.

Stormwater Management Guidebook – the current manual published by the Department containing design criteria, specifications, and equations to be used for planning, design, and construction, operations, and maintenance of stormwater and best management practices.

Surface Water – all of the rivers, lakes, ponds, wetlands, inland waters, streams, and all other water and water courses within the jurisdiction of the District of Columbia.

Temporary Well Casing – a durable pipe placed or driven into a borehole to maintain an open annular space around the permanent casing during construction of a well.

Unconfined Aquifer – an aquifer in which no relatively impermeable layer exists between the water table and the ground surface and an aquifer in which the water surface is at atmospheric pressure.

Unconsolidated Formation or Aquifer – any loosely cemented or poorly indurated earth material including such materials as uncompacted gravel, sand, silt and clay. Alluvium, soil, and overburden are terms frequently used to describe such formations.

Waters of the District – flowing and still bodies of water, whether artificial or natural, whether underground or on land, so long as in the District of Columbia, but excludes water on private property prevented from reaching underground or land watercourses, and also excludes water in closed collection or distribution systems. [Statutory]

Water Quality or Quality of Water – refers to the chemical, physical, biological, and radiological characteristics of water.

Water Supply Well – a potable or non-potable well used to supply water for industrial, irrigation, or domestic purposes.

Well – any test hole, shaft, or soil excavation created by any means including, but not limited to, drilling, coring, boring, washing, driving, digging, or jetting, for purposes including, but not limited to, locating, testing, diverting, artificially recharging, or withdrawing fluids, or for the purpose of underground injection. [Statutory]

Well Casing – a pipe placed in a borehole to provide unobstructed access to the subsurface or to provide protection of groundwater during and after well installation, or both. Inner well casing (also known as riser pipe) which extends from the well screen to or above the ground surface provides access to groundwater from the surface and outer well casing is used to prevent migration of contaminants from one aquifer to another.

Well Construction Permit, Well Permit Application, or Well Construction Building Permit – The use of these terms within the well regulations or the guidance document is synonymous and has the same intended meaning. A building permit issued by DCRA with a well construction work plan approved by the Department.

Well Development – the act of removing fine particulate matter or fluids used during the construction of a well to clear the well and establish a good hydraulic connection with the surrounding aquifer by any means, including surging, jetting, overpumping, and bailing.

Well Owner – a person who has the legal right to construct a well for personal use or for the use of another person. [Statutory]

Well Screen – a structural device which supports the well excavation, allows entrance of sub-surface fluids into a well or exit from a recharge well, and which acts as a filter to keep sediment from entering a well.

Wetland – a marsh, swamp, or other area periodically inundated by tides or having saturated soil conditions for prolonged periods of time and capable of supporting aquatic vegetation. [Statutory]